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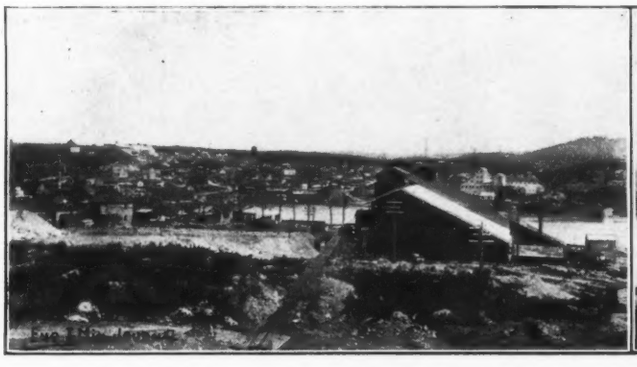
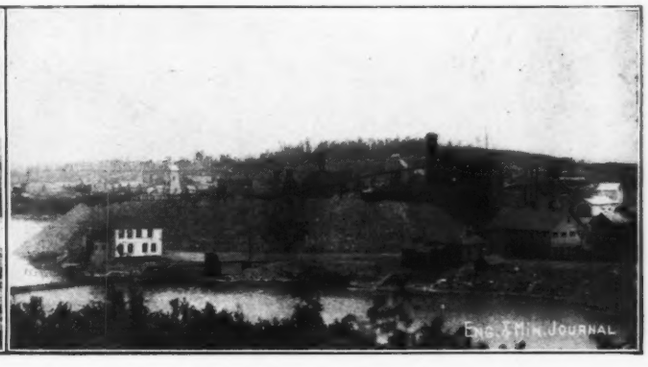
The Coniagas Mine, Cobalt, Ontario

By Reginald E. Hore*

The Coniagas mine is one of the leading producers of the Cobalt district and a remarkably profitable small mine. In the six years since incorporation, the company has paid in dividends and bonuses $4,280,000, or $280,000 more than the total capital, and the president reports the ore reserves to be greater now than at any other time in its history. The property comprises only 40 acres and very little mining has been done at a depth of over 300 ft. It is not expected that the rich ore will continue to great depth, as most of it occurs in shallow Huronian sediments and these rocks are underlain by Keewatin rocks, in which comparatively little silver has been found.



View across Cobalt Lake



View across Kerr Lake

The contact of these two formations dips to the east and the oreshoots pitch in a direction parallel to the contact, as may be seen from the accompanying stope map of vein No. 2. The reserve in these shallow orebodies on Oct. 31, 1912, was estimated by the company's engineer at 17,441,800 oz. of silver. It is reasonable to expect that some other veins will be found as development continues, but the management is not very confident of making many discoveries, as part of the property has not shown up well on exploration.

Discovery of the Mine

The cost for mining and concentrating in 1911-12 was 8.515c., and for shipping, smelting, refining and marketing 4.445c. per oz. of silver. The ores are remarkably rich and the methods of mining and treating them are successful. Before describing these, it is interesting to read of the discovery of the deposits, as told by W. G. Trethewey in the "Davis Handbook of the Cobalt Silver District." Mr. Trethewey says:

I left Toronto on May 6, 1904. My idea was to buy something in the camp, but I discovered that no one was prepared to sell. I went back to Haileybury and started to prospect. On the second day about four o'clock I struck out in a northerly direction, to a section to which no one had paid any attention. I walked almost straight to the old Trethewey mine. I passed over several ridges until I struck one where the rock looked good and I followed it south. As I walked along it I could see where the other fellows had torn away the moss. I came to a bluff where the point ran down into a swamp. I had to wade into the water to get round its western face. I could not see the face of the cliff until I had got out about 20 ft., when I saw a black streak on its face and I knew it was a silver vein. My first anxiety was to see if anyone had been there before me, but after a careful examination, I concluded that it was a virgin discovery. I hid it as well as I could by throwing sticks and moss over the rock where I had chipped it, and I came down to my tent and quietly had my tea. I started out with my ax on my shoulder slowly enough until I got out of sight, of the camp, and then I only hit the ground at the high places. I squared a post, put the number of my license and my name on it, and planted it firmly over the discovery. And I made a witness tree. Then I started along the bluff a little farther and discovered the Coniagas mine.

I put in the first little steam plant that went into Cobalt, and then the dynamo for electric light. We shipped the second car of ore that ever came out of the camp, on Oct. 1, 1904. I sold out in the fall of 1906, having at that time taken out $600,000 in ore.

Ore Occurs in Narrow Veins and Crevices

The ore occurs in thin veins, commonly less than six inches in width, and also in minute crevices in the wall rock. The vein ore is high grade; much of it averages 3000 oz. silver per ton; the wall rock that is mined averages about 20 oz. per ton.

The veins are vertical fissure fillings in Huronian conglomerate, graywacke and quartzite, which lie unconformably on rocks of the Keewatin series. The discovery was made near the contact where the sediments are thin. It was soon found that the silver disappeared at or near the contact, but that it continued with depth to the east. Comparatively little rich ore has been mined from the Keewatin rocks. The ore is localized in the lower few

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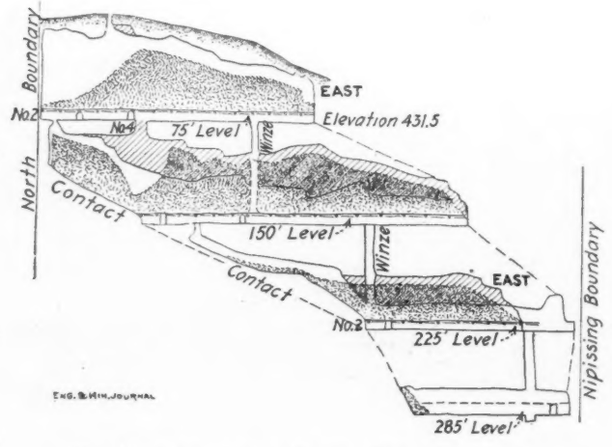
hundred feet of the Huronian and does not outcrop where the conglomerate is thick.

The fissures are not extensive ones and the wall rocks in most cases show little evidence of movement. Clean-cut fractures in hard, firm rock have been filled with rich ore and not greatly disturbed since deposition took place. There are numerous faults, but most of them show displacement of only a few feet and the rock along the faults has not been notably changed. Considering the age of the rocks the amount of deformation is unusually slight.

Silver, Cobalt and Nickel Are the Metallic Vein Minerals

The ore is native silver accompanied almost invariably by arsenides of cobalt and nickel, of which smaltite, chloanthite and niccolite are the most common. The common gangue mineral is a carbonate of the calcite-dolomite series. Quartz is comparatively rare in the veins. In places ruby silver occurs, but it is seldom present in more than film-like coating on fracture surfaces.

While silver is the only product for which the mine owners receive any large return, the ores are also an important source of arsenic, cobalt and nickel. The origin of the peculiar name of the mine is therefore evident: Co Ni Ag As. The 4893 tons of ore shipped from the beginning of production up to Oct. 31, 1912, contained 7,872,943 oz. of silver, an average of over 1600 oz. per ton. The 172,715 tons milled yielded 3777 tons of concentrates containing 4,760,353 oz. of silver. The ore shipped contains from 2 to 12% of cobalt and about 25% of arsenic. During the last year arsenic was sold at from 2 to 4c. per lb. and some cobalt and nickel at low prices.



Stope Map, No. 2 Vein, Coniagas Mine

Mining Methods Are Simple

The workings on the several veins are all connected and ore is hoisted from one shaft only. A second shaft, formerly used for hoisting, now serves for a manway and for ventilation. The shafts are vertical and were sunk on veins. The working levels are at depths of 75 ft., 150 ft., and 225 ft. The veins reached by crosscuts are developed by drifts and winzes as indicated in the stope map of No. 2 vein.

In mining the ore, the narrow vein is kept in the middle of the breast, as there is usually milling ore for a foot or two on each side of the high grade. Frequently there occur two or three parallel veins close together and the stopes are in places widened to 15 or 20 ft. Where there are parallel high-grade veins a few feet apart, the intervening rock commonly carries enough silver to make it a profitable ore.

The drifts are carried eight feet high and five to 20 ft. wide. A cut of eight feet is then taken off the back to give the necessary room for timbering. The level is protected with lagging of 4- to 6-in. spruce and jack pine, laid on stulls hitched into the walls. Chutes with a 2-ft. opening, are built at intervals of 25 ft. to draw off the ore. Stoping is commenced by breaking down the ore carefully on the lagging, and is continued by keeping the stope full of broken ore and working up on it.

It is customary in drifting and cutting out to have a man employed as sorter. He examines the ore as it is being loaded into the cars and bags the high-grade. No regular sorter is employed in the stopes, but the miners bag some of the rich ore. The bagged ore is sent up at the close of each shift and goes direct to the smeltery without any treatment at the mine.

The rock is hard and compact. To avoid the necessity of block holing and sledging large chunks, an endeavor is made to break the rock in small pieces by drilling many holes and loading them lightly. The drills used were invented by John Redington, formerly superintendent of the Coniagas, and are manufactured by the company. They are two-man piston machines and are said to give good results.

Milling Is Entirely Concentrating

The ore is loaded from the stope chutes into cars holding about 1300 lb. and trammed to the shaft. Here it is emptied into a pocket from which it is loaded in a skip of about 3000 lb. capacity. At the surface the skip dumps automatically and the ore runs over a grizzly to the mill bin. From the bin it passes to crushers and screens; the oversize of 1¼ in. is hand sorted on a belt; the undersize is jigged. The tailings from picking belt and jigs are stamped, and the pulp after settling in tanks is concentrated on Deister sand and slime tables and canvas tables. About one-half of the silver in the ore from the mill bin is recovered without stamping, by hand picking, jigging and treating the mine slimes on a Wilfley table.

Chinese Metal Exports

The figures for Chinese metal exports for 1909, 1910 and 1911, as reported by the Chinese Maritime Customs, are given in the *Mining Journal*, Feb. 15, 1913, and are reproduced in the accompanying table. These figures

CHINESE METAL EXPORTS (IN METRIC TONS)

	1909	1910	1911
Tin	4,516.5	6,510.0	6,055.9
Iron ore	89,110.9	132,323.2	112,299.2
Iron and steel	37,322.1	60,857.1	69,743.0
Coal	11,851.3	19,240.6	19,747.8
Antimony ore	776.8	5,761.4	6,812.1
Refined and crude antimony	7,937.9	6,644.0	6,896.8
Lead ore	4,039.2	5,176.3	5,410.2
Pig lead	268.8	250.3	561.4
Zinc ore	7,579.0	9,785.8	4,539.3
Spelter	15.8	328.1	710.1
Quicksilver	55.0	48.5	18.0

are, because of the uncertainty surrounding production, the best criterion available as to mining activity in that country.

Cyaniding at Grass Valley, California

By Herbert A. Megraw

SYNOPSIS—Cyanidation after amalgamation of a free-milling gold ore. The North Star Mines Co. operates two separate mills, each having about the same capacity. The Central mill, being typical, is studied in detail. The solid-masonry bin construction is unusual and good. Crushing is by stamps with a special type of screen. Concentration is practiced. Separate treatment of sand and slime is followed and zinc dust is used for precipitation. All solutions are clarified by passing them through the sand-leaching tanks. Continuous revolving filters are used for filtering slime. Concentrate treatment is unusual, consisting of regrinding the concentrate, amalgamating it and passing it back into the regular treatment system. The situation of the camp is exceptionally good and buildings are substantial and of pleasing exterior.

The North Star Mines Co., situated near the town of Grass Valley in Nevada County, Calif., operates two mills, one built at the shaft of the mine, known as the North Star mill, and one situated in a cañon near the town, known as the Central mill. The Central is the newer mill, built much later than the old North Star mill. They are both 40-stamp installations and treat about the same quantity of ore in exactly the same way, the only difference being that the older mill does not attempt to treat the concentrate made in it, but sends it to the Central mill for reduction. Owing to these facts the Central mill will be discussed in his paper, its system typifying the practice established by the company and illustrating the method of concentrate treatment.

Central Mill

Central Cyanide Plant

North Star Mines, Grass Valley, Calif.

Gold Occurs in Sulphides in Quartz

The ore is a free-milling quartz in which quantities of sulphides occur, and it is principally in these sulphides that its value lies. The principal valuable metal is gold; silver exists in small proportion, but not sufficient to justify any special metallurgical efforts to recover it. The gold is principally in mechanical association with the sulphides, only a small proportion being in chemical combination. In crushing, the ore may be said to be of medium hardness. It consists principally of quartz.

Each of the mills of the company contains 40 stamps, and the combined capacity of the two is about 9000 tons per month, or about 300 tons per day. The average ore treated in the mill is valued at about $10 to $12 per ton.

Light Stamps Used for Crushing

The ore is brought to the Central mill in small cars drawn by a light electric locomotive. It is dumped into a general bin from which it passes over a grizzly, the coarse rock being reduced in size in crushers of the Blake type and the whole finally received in the battery bins.

The construction of these bins is noteworthy in that they are entirely of masonry, forming a massive and solid foundation for the crushers. They are built directly on the hillside and are a fine example of permanent construction.

From the battery bins the ore is drawn through disk feeders into the mortars. There are 40 stamps of 1000 lb. each dropping 110 times per min. through 7 in. Inside amalgamation is practiced, using chuck plates, and there is also an outside lip plate. The regular apron plates follow as is usual.

The screen in use is somewhat unusual, consisting of a light sheet-steel plate punched with small round holes. These holes are grouped in small squares of about 1 in. on a side, and the squares are separated by ribs of the solid metal, about as shown in the illustration. The size of the holes is such that they approximate the opening generally found in a 30-mesh wire screen. The separating ribs add strength to the screen. The whole length of the mortar, with a width of about one foot, is occupied by the screen which has no strengthening strips aside from the ordinary wooden frame used to retain it.

The battery framing is entirely of steel. The driving arrangement is a little out of the ordinary as the motor is situated above the batteries and the driving belts lead down, with one reduction, to the camshaft. The accompanying illustration shows this arrangement. By this means the battery motor is given a firm foundation on the masonry of the bins and all belts and pulleys are easily reached when desired.

Note—This is the fifteenth of a series of articles by Mr. Megraw on American cyanide practice. Previous articles appeared Nov. 2, Nov. 23, Dec. 14, Dec. 21, Dec. 28, 1912; Jan. 4, Feb. 8, Feb. 15, Feb. 22, Mar. 1, Mar. 8, Mar. 29, Apr. 5 and Apr. 26, 1913. The next article will deal with "The Black Oak Cyanide Plant, Calif." and will appear on June 14, 1913.

From the plates the pulp is led to a series of concentrators which are round, of the buddle type, but have a reciprocating motion, revolving back and forth about a central point, through a small arc. The concentrate is removed at a point on the edge of the circle. An arrangement is made for reconcentrating the middling of a number of these tables on others. The machine is known as the Dodd buddle.

From the concentrators the pulp flows to the cyanide plant, which is separate from the mill and situated at some distance from it. All crushing and concentration is done in water and the pulp flows by gravity to the cyanide-treatment plant.

Cones for Classification

All the pulp is received at the cyanide plant in a roughing cone, 7x6 ft. The overflow from this cone goes immediately to the cyanide department as slime, the object being to take out the majority of the slime, and slime only, leaving the cone underflow to be further classified in a separate system. This system consists of three cones, each 5x5 ft., using an upward current of water to assist in the classification. One of these cones has straight sides, but of approximately the same size as the other two, and its operation is the same. Clean separation is accomplished in these cones and their overflow joins the stream of slime from the roughing cone and forms the slime portion of the pulp.

Separate Sand and Slime Treatment

The underflow of the cones is taken directly to the leaching tanks where the first cyanide solution is put in contact with it.

The leaching tanks are six in number, each 22 ft. 5 in. by 87 in. and are served by distributors of the Butters type. The cyanide treatment occupies about seven days in total. At first a wash of lime water is applied to neutralize any acidity in the ore and prepare it for the cyanide solution which follows. After this has been drained away a bath of 30 tons of pregnant solution from the filters is applied which has strength of about 0.035% KCN. This is immediately drained and is followed by a bath of barren solution containing 0.1% KCN. The tank is filled with this solution, which is allowed to remain in contact with the charge for 24 hr. with the tank outlets closed meanwhile. After this soaking period, the solution is allowed to drain into a special solution tank until it shows a strength of 0.06% KCN, when it is turned into the strong sump, where it finally reaches a strength of about 0.09% KCN. Other strong washes are followed by washes of solution from the filters and finishes with the barren solutions which are to be wasted after being precipitated, and finally a water wash is applied. The sand, after treatment, is sluiced out of the tanks. There is no scarcity of water.

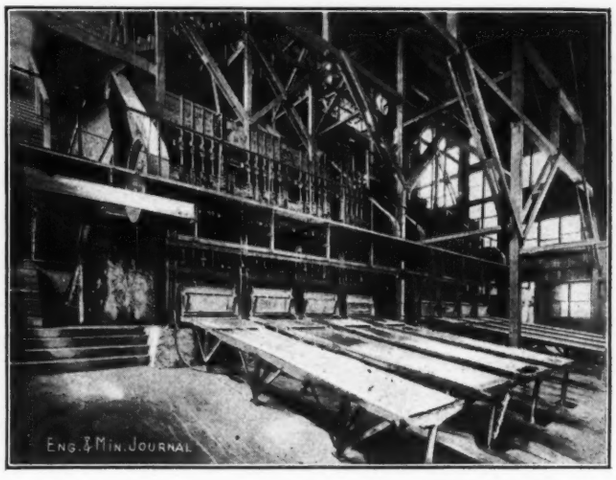
Slime Collected and Partially Dewatered

The slime is all collected in a series of cone-bottomed settling tanks, assisted by one Dorr thickener. There are six of these settling tanks, three of which are 14x15 ft. and three 13.3x9 ft. The Dorr thickener is 19.5x13.5 ft. and is arranged to make one revolution in 3 min. 50 sec. The slime is thus dewatered, leaving a pulp having specific gravity of about 1.3 and a dilution of 2:1, approximately.

In a system of this sort, where an appreciable amount of water is taken into the cyaniding system, it is evident that it will have to be discarded at some point. This introduces a condition somewhat difficult to handle and it is only where weak solutions are used that it is practicable. At the Central mill weak solutions are used in slime treatment and for leaching the sand. With sand treatment by leaching it is possible to reduce the incoming moisture to about the same quantity discharged with the tailings, so that in this department there is little or no accumulation of surplus solutions. This can be accomplished with slime also, but is an expensive process, in fact it was tried at the Central mill at one time but it was soon found to be more economical to waste a selected, precipitated solution, with its cyanide content reduced to the lowest possible point, than to undertake the expense of more complete dewatering.

Continuous Slime Treatment

The partially dewatered slime is recovered in a stock tank, from which it is taken to the agitation depart-



Stamp Battery and Plates, Central Mill of North Star Mines

ment and the necessary cyanide added to bring up the strength to the treatment standard of 0.035% KCN. The slime, with its added cyanide and solution, goes then to the treatment tanks.

The tanks used for agitation are 8 ft. diameter and 18 ft. deep and have cone bottoms of 60° inclination. The agitation is by means of a central lift pipe. It will be noted that these tanks are practically Pachuca tanks, except that the lift pipe does not reach the surface of the pulp, a feature which has been adopted with some advantage in a few Pachuca installations. Air is used for operating the lifts. It is of interest to note that these tanks are said to have been installed and in use before the Pachuca type, as such, came into existence.

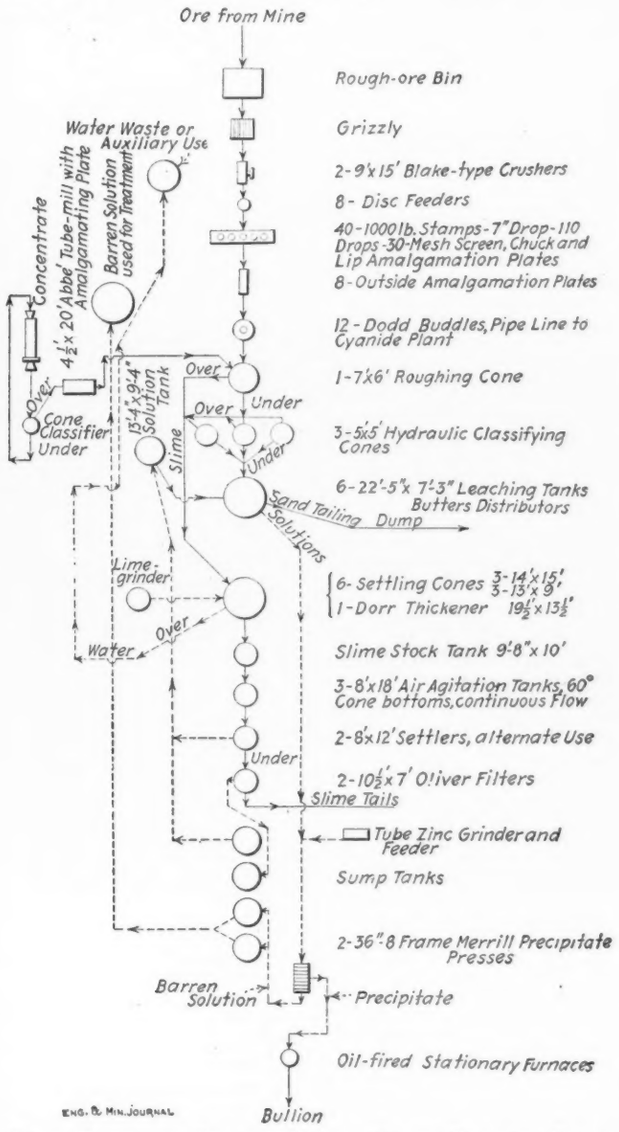
The agitation of the slime pulp is continuous through the three agitators, the time of passage being calculated at approximately 14 hours.

Oliver Continuous Filters Used

The pulp from the agitators is collected in two settlers, used alternately, each 8x13 ft., equipped with cone bottoms. Settling and decantation proceed simultaneously, the thickened pulp meanwhile being drawn off for

filtration. In about eight hours, one settler is filtered so that the overflow is not clear, when the pulp is transferred to the other settler, the first one being allowed to settle, the solution decanted, and the thickened underflow drawn off as it settles.

The thickened pulp is taken to the filters, this installation consisting of two 10½x7-ft. Oliver continuous revolving machines. It was at this mill that the Oliver filter was conceived and developed and the two machines now in use are the first of their type to be built.

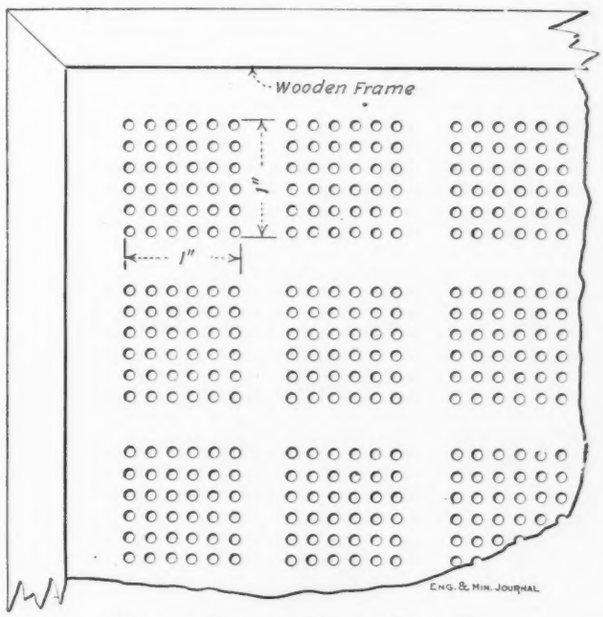


Flow Sheet of Central Mill, Grass Valley, Calif.

The tailing is sluiced away from the filter and run to waste. About 60 tons of slime daily are treated on the two filters.

Pregnant Solutions Clarified through Sand Tanks

The Merrill system of precipation is used. Zinc dust added to the pregnant solution is pumped through two Merrill presses, each of which contains eight frames, the frames being the 36-in. triangular type. These presses originally had the solution discharge at the bottom of the frame, but pipes have been fitted to the discharges and carried above the level of the frames so that the press always remains full even in case of cessation of operations of the plant. The frames thus kept full of solution prevents oxidation of the zinc consequent upon an empty frame and resulting contact of air with the zinc. All solutions to be precipitated are first used as washes on the sand-leaching tanks, enriching the solutions and effectually clarifying them. The precipitate is melted in stationary, oil-fired furnaces without any preliminary treatment whatever. A small tube mill is used for emulsifying the zinc dust with solution before its addition to



Screen Used at North Star Mill

the solution to be precipitated, and a mechanical feeder introduces the zinc into the tube mill.

Concentrate Treatment

The concentrate treatment is unusual and worthy of particular note. The two mills of the company make six to seven tons of concentrate daily, all of which is treated at the Central mill. It is brought to the mill in cars and is dumped into a concentrate bin, being meanwhile mixed with lime at the rate of about nine pounds per ton. From this bin the concentrate is mechanically fed into a tube mill of the Abbé type. The mill is 4.5 ft. in diameter and 20 ft. long and revolves at 19 r.p.m. The concentrate is reground in this mill, and issuing, it is classified in a cone classifier. The fine overflow all goes over an amalgamating plate and the underflow is returned to the tube mill, forming a closed circuit from which there is no exit save through the overflow of the reclassifying cone. All of the reground concentrate pulp, after having passed this regrinding and amalgamating system, is taken directly to the large roughing cone, before mentioned, at the head of the cyanide plant, where it enters treatment along with the bulk of the ore.

Thus the concentrate, after having been removed from the pulp, is ground, amalgamated, and returned to it and undergoes exactly the same treatment as the siliceous part of the ore. This treatment is said to be altogether satisfactory, the regrinding being sufficient to liberate most of the contained gold, a part of which is recovered on the plate and the remainder in the cyanide treatment. The portion which goes to the cyanide plant is amenable

to the short-time and weak solutions used there. The explanation, of course, is that the gold is only mechanically combined with the sulphides and is liberated by the additional grinding. In the case of chemical combinations other means would be necessary for its satisfactory extraction.

This is a good illustration of the utility of experimental work, for it has here fitted an inexpensive process to a material which needs nothing else. A separate treatment, such as is usually considered necessary with sulphides, might have been considered necessary in this case and an expensive plant and treatment system might have been installed had not thorough experiment shown the exact requirements of the material.

The concentrate varies in value from $30 to $80 per ton and the extraction is about as complete as with the siliceous portion of the ore. As has already been said, the mill head averages $10 to $12 per ton, and the head of the cyanide plant averages about $2 per ton, before the concentrate is added. The total extraction obtained from mill and cyanide plant approaches 98%. In the cyanide plant alone, about 94% of the gold in slime is recovered and 85 to 90% of that in the sand. The tailing contains on the average about $0.20 in gold value.

Consumption of Material and Cost

The consumption of cyanide is 0.61 lb. per ton milled; of zinc, 0.216 lb. per ton; of lime, 4.21 lb. per ton, and of pebbles, 4.5 lb. per ton of sulphides ground.

The cost of treatment is given in the accompanying table.

	Milling	Concentration	Cyaniding
Labor	$0.176	$0.087	$0.166
Material	0.075	0.017	0.186
Power	0.129	0.027	0.116
Total	$0.380	$0.131	$0.468

Milling	$0.380
Concentration	0.131
Cyanidation	0.468
Total	$0.979

The Empire Mill

The Empire mill is also near the town of Grass Valley. The mine and mill are close together, although as in the case of the Central, the milling and cyanide departments are in separate buildings.

The ore at the Empire mill is like that at the North Star, a free-milling quartz containing sulphides. The mill is similar, and in fact, the treatment is almost identical, so that it will not be necessary to make a detailed study of that practice, but attention will only be called to the few points of difference.

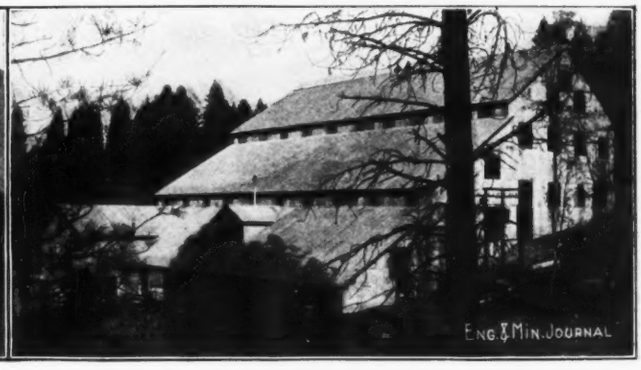
The Empire mill contains 40 stamps of 1050 lb. each and amalgamation is practiced both inside and outside the mortars. The quantity of ore milled is from 140 to 150 tons per day, about the same as the North Star mills. Concentration is practiced as is the case at the other mills.

Cone Classifiers Used

The mill pulp flows through a pipe line to the cyanide plant, where it is received in two roughing cones, the slime overflowing and going directly to settlers and the underflow passing for further classification to four hydraulic classifying cones, which make the final separation into sand and slime.

The sand is taken directly to the leaching tanks and is delivered into them by means of Butters distributors. A feature of the practice both at the Empire and Central mills is that the Butters distributors are used both in filling the tanks and also in sluicing out the residue. For sluicing out the sand, water is admitted through the distributor, the bottom gate opened, and sluicing proceeds automatically. The filter bottom of the tank is made slightly inclined, in order to facilitate the discharge. The sand tanks are 14 ft. by 9 ft. 4 in., and contain approximately 155 tons. The treatment occupies six days and the strong solution is 0.10% KCN, as in the case of the Central mill.

Empire Mill



Empire Cyanide Plant

Grass Valley, Calif.

Large Settling Area Required

The slime from the classifiers is taken to the settlers. There are four of these, each 24 ft. in diameter and 22 ft. deep, with cone bottoms. The pulp is distributed among them as conditions dictate. This settling capacity seems extensive for the quantity of slime handled, about 65 to 70 tons daily, but it is stated that the settling, even with this great capacity, is accomplished only with great difficulty. A large quantity of lime is added to assist settlement, most of this lime being lost in the overflow water, which is either run to waste or used in auxiliary operations about the plant, there being none returned for further use in milling.

It is an object to draw the slime from these settlers with as little moisture as possible, the dilution usually being about 1:1. As the thickened pulp reaches the agitation department it is diluted to about 2:1 with fresh solution and is made up to 0.04% cyanide strength.

Pachuca Type Agitators

The agitation is continuous through four tanks of the Pachuca type, each 10x18 ft. The cyanide strength is made up in the first and last tanks of the series and a low protective alkalinity maintained. There is no thickening or washing of the pulp after agitation except that given in the filters, to which the pulp is taken directly from the agitation tanks. The filter installation consists of two Oliver machines of the 8-ft. size.

As at the Central mill, all solutions to be precipitated are first used as washes on the sand tanks in order to clarify them. The Merrill system of zinc-dust precipitation is used, and there are two triangular frame presses, 36-in. frames, having nine and ten frames respectively. These presses have pipe connections for the solution outlets which deliver above the level of the top of the frames. The precipitate is acid treated and melted.

Concentrate Treatment About the Same

The concentrate treated, about four tons daily (part of which is purchased), is reground in a 4x8-ft. Allis-Chalmers tube mill, run over plates and classified at the cyanide plant in a separate cone, the overflow of which joins the stream of slime to the settlers and the underflow, the product going to the sand-leaching tanks. This separate classification is the only detail in which the concentrate treatment differs from that in use at the Central mill.

The general arrangement at the Empire mill is somewhat less complicated, as it is understood that the mill stands exactly as designed and the necessity for inconvenient remodeling has been avoided.

The Grass Valley mines present mining in its most attractive form. Situated in a fertile agricultural district, free from climatic extremes and surrounded by luxuriant vegetation, the aspect differs widely from the usual mining camp. The district is old, the first discovery was in 1850, and proven, so that makeshifts and cheap construction have long since given place to substantial installations, an artistic eye having evidently been concerned in the general plans. This is especially true at the Empire where stone buildings and pleasant foliage give an appearance more like that generally presented by well designed and permanent habitations than mining camps. Those concerned in the operation of these mines are fortunate indeed in their habitation.

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Sloss-Sheffield Steel & Iron Company

The report of this company for the year ended Nov. 30, 1912, shows its capital liabilities unchanged at $10,000,000 common stock, $6,750,00 preferred stock and $4,000,000 bonds. The company is a maker and seller of pig iron, owning its ore mines, coal mines and coke ovens, as well as its blast furnaces.

The financial statement for the year is given as follows:

	1911	1912	Changes
Gross sales and earnings	$4,521,360	$5,299,719	I. $778,359
Working and general expenses	3,789,602	4,422,055	I. 632,453
Net earnings	$731,758	$877,664	I. $145,906
Fixed charges	$210,000	$210,000	.....
Depreciation	117,110	114,409	D. $2,701
Total charges	$327,110	$324,409	D. $2,701
Surplus	$404,648	$553,255	I. $148,607

Depreciation includes charges for coal and iron ore mined. A charge of 25c. per ton is made on all pig iron produced to provide for extraordinary repairs. The net profit on pig iron sold was $453,962; on coal, $74,756; on coke, $108,506; on ore sold, $1854. From the surplus for 1912 a dividend of $469,000, or 7%, was paid on preferred stock, leaving a balance of $84,255 to current year. The net working capital was $1,408,949 at the close of the year.

The average price of pig iron sold showed an advance of about 10c. only over 1911, as the general advance in pig iron came late in the year. Production was not increased, but stocks on hand were cut down from 88,000 to 25,000 tons. Coal-mine operations were curtailed by poor railroad service. At the Sloss iron mines the cost increased 7c. per ton, but this has been cut down by improved machinery. The Russellville brown-ore mines show a decreased cost on a larger production.

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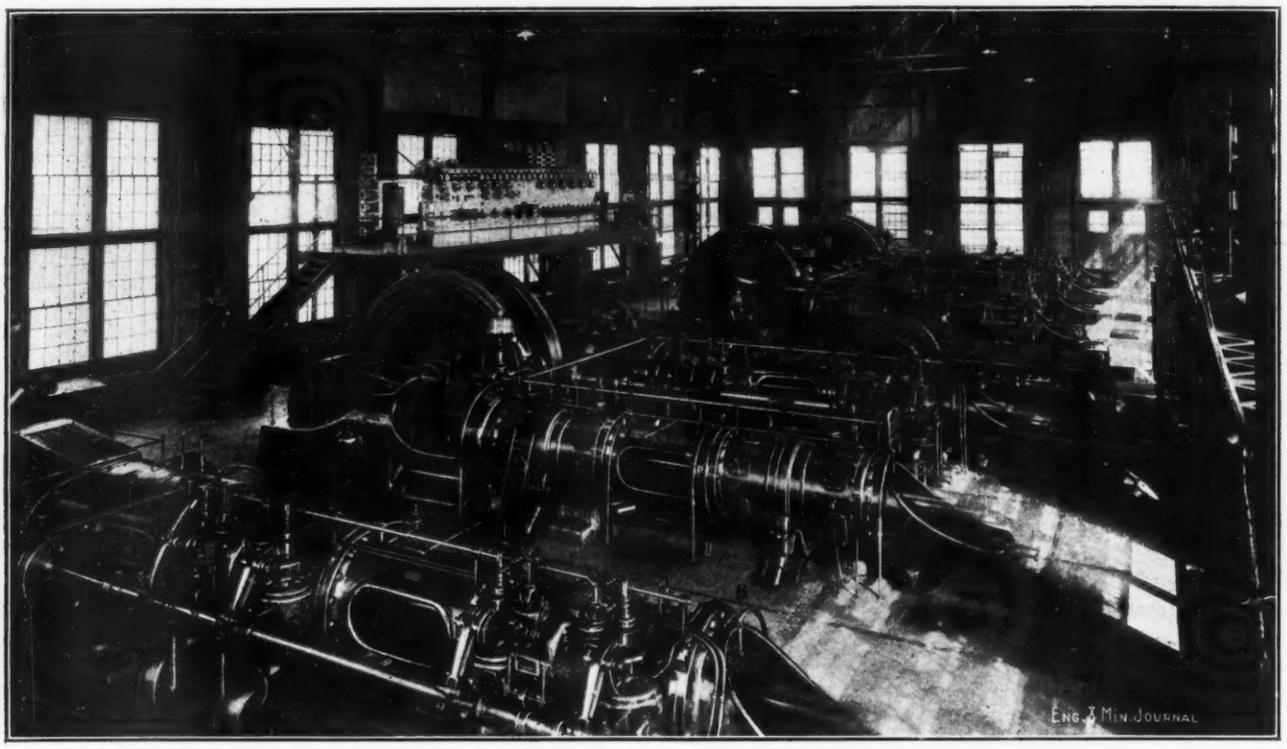
Annual Report, British Columbia Copper Co.

The report of the British Columbia Copper Co., Ltd., covers 13 months, including December, 1912. During that period the smeltery treated 740,589 tons of ore, of which 443,022 tons were derived from the company's mines, the rest being custom ore. From this ore there was produced 11,146,811 lb. of fine copper; 142,025 oz. of silver; 25,863 oz. of gold. During the year the company expended $229,489 in the purchase, exploration and development of new properties. These consisted of six groups in the Princess camp, two groups near Nelson, one group near Silverton, one on North Fork Kettle River, one in the Copper Mountain district, and one in the Deadwood camp. Work on the first nine of these was so encouraging as to justify additional payments on the options. On the last two, development was abandoned for the time being. The company acquired control of a group of claims in the Voigt camp, on Copper Mountain, and added to its holdings in New Dominion securities. It hopes to obtain a good tonnage of concentrating ore from the Princess camp.

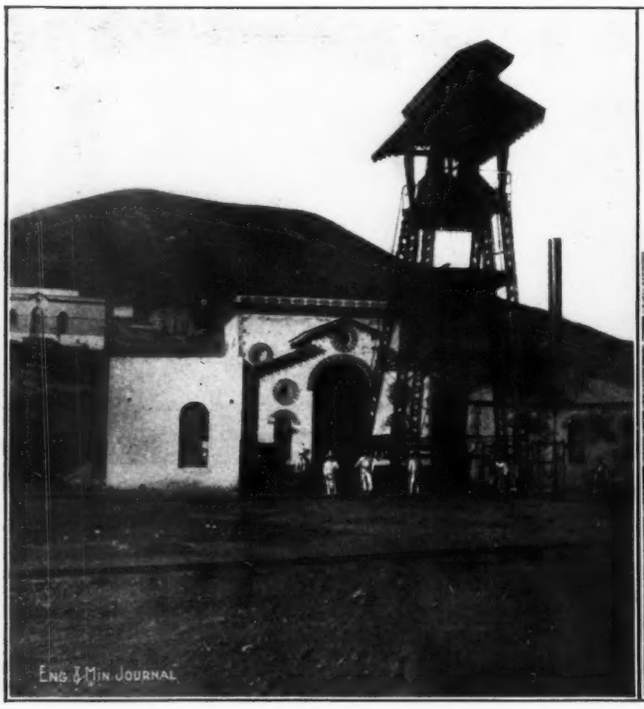
Of the shipments from the company's mines, 410,686 tons came from the Mother Lode mine. A cost of 56.58c. per ton, f.o.b. cars, was obtained at this mine. The same methods of stoping were continued, and the end of the year saw about 5000 holes ready to blast. There was no increase in reserves and the average grade remained below the normal of former years. The mine in the Wellington camp was closed in June for the time being. The ore in the Lone Star and Washington mine is refractory, although a large tonnage is developed. The mine was worked for three months in the summer only. Conditions at the Napoleon and Queen Victoria mines are satisfactory. Extensive examination and prospecting in British Columbia was prosecuted throughout the year. The yield per ton for the year decreased, so that in spite of a reduction in costs per ton the cost of production was 12.85c. per lb. of copper. The cost per ton from ore in place to sale of the contained metal is given at $2.46.

The proceeds of metal shipments for the year were $2,483,664, and miscellaneous earnings were $7614, from which are deducted operating expenses of $1,570,205 and ore purchases of $495,087, leaving earnings of $425,986.

PHOTOGRAPHS FROM THE FIELD

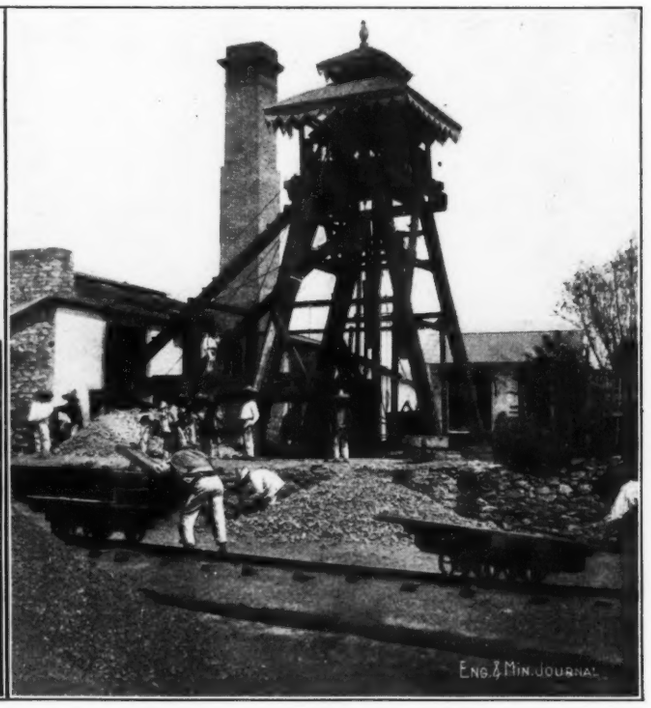


LARGE POWER PLANT OF DOE RUN LEAD CO., SOUTHEASTERN MISSOURI, USING GAS-ENGINE DRIVE



SAN BALDOMERO SHAFT OF THE CINCO SEÑORES MINE, AT POZOS, GUANAJUATO, MEXICO

A combination of modern steel headframe and old Mexican architecture.



SAN AUGUSTIN SHAFT OF THE CINCO SEÑORES MINE, POZOS

Older type of wooden headframe construction in Mexico, typically Mexican.

Gas Waste in Oklahoma

A report was recently received by Secretary Lane, of the Interior Department, that there is a waste of natural gas on Indian leased lands in Oklahoma amounting, as is claimed, in one field, the Cushing field, to approximately $20,000 a day (*Oil, Paint and Drug Reporter*. Apr. 26, 1913). The secretary sent a telegram to the officials in charge of the matter at Muskogee, Okla., as follows:

Bureau of Mines has made preliminary report on waste of gas, especially in Cushing field. Advise all operators that continued waste will not be permitted, and if not stopped at once steps will be taken for cancellation of leases or for such other remedy as may be deemed proper. Keep department posted.

In connection with this telegram, the secretary calls attention to the regulations attending leases of gas lands in the Indian country, whereby a nominal fine of $10 a day is imposed if the waste is permitted to go on and that the precise provisions of these regulations providing for a failure on the part of the operator to prevent the waste of gas will subject the lease to cancellation. The secretary says that the fine is wholly inadequate, and it is proposed to change the regulations at an early day in order to provide for a suitable penalty.

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Radium Production in America

By Ernest H. Heinrichs*

Some of the largest and most important operations in radium carried on in America are controlled by the Standard Chemical Co., of Pittsburgh, Penn. That company has acquired 91 ore claims in Paradox Valley, Montrose County, Colo., covering approximately an area of 1000 acres. The deposits found here have been thoroughly tested and shown to contain a high-grade carnotite ore containing uranium, vanadium and radium. The mines so far have an output of 100 tons per month from which the refining process yields about one gram of radium.

While the ore deposits are accessible and the mining does not present any physical difficulties, the transportation of the product is somewhat more complicated. The company's reduction works are situated at Canonsburg, Washington County, Penn., about 19 miles from Pittsburgh. The ore to reach this place, is packed at the mines in bags containing about 80 lb. each. These bags are carried by burros through the Uncompahgre Mountain region for a distance of 20 miles, where the bags are loaded on wagons and hauled 35 miles to Placerville, the nearest railroad point. The railroad at Placerville is a narrow-gage line which runs to Pueblo, Colo., and shipments have to be reloaded at the main line for transportation to their destination at the Canonsburg mills. At these mills the radium is obtained in the form of raw chlorides. In this shape they are taken to the company's radium research laboratory at Forbes and Meyran Avenues, Pittsburgh.

This laboratory is a unique institution. There is no other that can be compared with it either in completeness or equipment or in the scope as well as elaborateness of its operations. There is no other radium laboratory producing so large a quantity of this precious metal, nor is there a place where radium applications and radium effects are so thoroughly studied through all their various ramifications than here. The most modern methods of radium production are in vogue, practised by a staff of scientific men, who have been gathered from many institutes of learning at home and abroad. The chief of the laboratory is Dr. Otto Brill, a graduate of the University of Vienna, and a coworker of Dr. Walter Nernst, the inventor of the Nernst lamp.

The product of the laboratory is used for scientific as well as for medical and therapeutic purposes. Its applications and effects are made a most minute study and experiments for new developments are constantly carried on. With its large supply of ore this laboratory expects within the near future to be in a position to furnish the world with radium in large quantities.

*Westinghouse Bldg., Pittsburgh, Penn.

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San Francisco Mines of Mexico

The report of Knox & Allen, consulting engineers of the San Francisco Mines of Mexico, is given in the *Mining Journal* of Mar. 29, 1913. This company was formed to work the group of mines situated about 14 miles from Parral, Chihuahua, Mexico, formerly owned by the San Francisco del Oro Mining Co., Limited.

The San Francisco vein is a fissure lode in limestone. The strike of this lode is north and the dip is easterly but nearly vertical. The property covers nearly 1½ miles on the course of the lode. The oreshoot worked at present is 2600 ft. long and has a minimum width of 5½ ft. In the stopes now opened, the width is greater. Below the third level the ore is practically unoxidized and the fourth level may be considered to be in primary ore. The gangue minerals comprise quartz, calcite, fluorite and silicified limestone. The economic minerals are galena, blende, pyrite and chalcopyrite. The valuable metals are silver, gold, lead and zinc and a little copper.

The main workings comprise three shafts and four levels. The lowest, or fourth level, is approximately 320 ft. below the collar of the main shaft. The fifth level will be about 165 ft. below the fourth level. The ore reserves are estimated at 390,000 metric tons. The average grade of this ore is approximately 21 oz. silver, 1.4 dwt. gold per metric ton, 12.5% lead, and 17.4% zinc. The geological formation and other indications point to persistence of the lode in depth, such that at least 500,000 tons additional should be obtained from the mine.

The mine ore is delivered by aërial tramway to the mill where it is crushed, sized and concentrated in jigs and on tables. The slime is not now treated, but is stored for future treatment. Many mistakes were made in the past in the design and construction of the mill. To remedy this condition, it is not intended to introduce any new methods of treatment, but merely to complete and perfect the installation already existing. At present the mine can produce and the mill can treat, while under reconstruction, 200 tons of ore daily. After the first year, it is believed that the mine can be worked at the rate of 90,000 tons yearly, which the reconstructed plant will be fully able to treat.

The actual profit in sight with 390,000 tons of reserve, is estimated by the consulting engineers as £870,000. If the minimum further yield of 500,000 tons is realized, this would give, it is estimated, an additional profit of £1,150,000, on the basis of 46s. per ton of ore mined.

Mineral Production of Great Britain

The British Home Office has issued advance sheets giving the statistics for 1912 of the mines operated under the Coal Mines Act and the Metalliferous Mines Act. In examining the statistics of output given in these tables, it must be borne in mind that the figures do not in all cases represent the total production of the minerals for the year. Large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, etc., are obtained from quarries under the Quarries Act, and from other open workings, the returns from which are not yet available. The totals for coal, and the ores of copper, lead and zinc, may, however, be regarded as substantially complete.

The output of coal from mines under the Coal Mines Act was 260,567,552 tons in 1912, as compared with 271,878,124 tons in 1911. The actual falling off in production is, however, somewhat less than the figures indicate. In previous years some owners have been in the habit of returning the gross weight sent out of the pit, including dirt; this year the net output of coal has been returned by these owners, who estimate that the amount of dirt which would have been included, if the returns had been made in the same way as in previous years, was 2,297,789 tons. The actual falling off, therefore, of output is 9,012,783 tons. A production of 62 tons of lignite is reported.

The production of iron ore thus far reported was, in long tons:

	1911	1912	Changes
Coal Mines Act	7,886,898	6,744,258	D. 1,142,640
Metal Mines Act	1,823,795	1,672,988	D. 150,807
Total	9,710,693	8,417,246	D. 1,293,447

As noted above, the total production of iron ore was greater than that shown in the table.

The production of metal and metal-bearing ores, all from metalliferous mines, with the exception of 8442 tons of iron pyrites, was as follows, in long tons:

	1911	1912	Changes
Arsenic	2,144	2,193	I. 49
Arsenical pyrites	1,170	1,778	I. 608
Copper ore and precipitate	3,244	1,912	D. 1,332
Gold ore	2,752	107	D. 2,582
Iron pyrites	10,114	10,522	I. 408
Lead ore	23,864	23,323	D. 541
Manganese ore	4,987	4,170	D. 817
Tin ore, dressed	6,618	6,817	I. 199
Uranium ore	67	42	D. 25
Wolfram ore	260	189	D. 71
Zinc ore	17,652	17,704	I. 52

The mining of gold ore nearly ceased in 1912. In addition to the tin ore reported in the table, 408 tons of undressed tin ore were obtained last year.

The production of other minerals for two years past from both classes of mines, is given in the following table:

	1911	1912	Changes
Barium compounds	42,550	42,767	I. 217
Bauxite	6,007	5,790	D. 217
Chert, flint, etc.	5,066	4,787	D. 279
Clay and shale	532,693	528,704	D. 3,989
Fireclay	2,482,846	2,279,059	D. 203,787
Fluorspar	31,587	28,691	D. 2,896
Gypsum	233,732	243,811	I. 10,079
Igneous rocks	59,901	61,385	I. 1,484
Limestone	421,854	355,433	D. 66,421
Ochre, amber, etc.	5,592	5,804	I. 212
Oil shale	3,116,803	3,184,826	I. 68,023
Rock salt	200,620	218,055	I. 17,435
Sand	16,375	13,621	D. 2,754
Sandstone and ganister	236,821	251,014	I. 14,193
Slate	110,608	101,648	D. 8,900

A small production of soapstone—8 tons—is reported in 1912. Changes in the production were generally small.

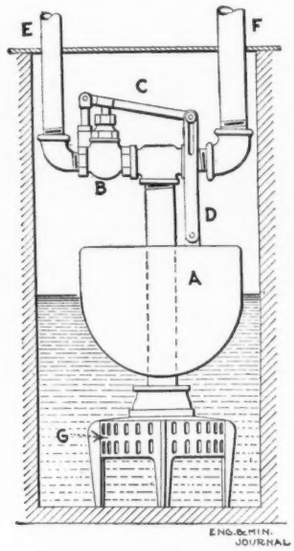
The total number of persons employed in mining these products in 1912 is reported as follows:

	Underground	Surface	Total
In mines under Coal Mines Act	878,811	210,354	1,089,165
In mines under Metal Mines Act	16,826	11,329	28,155
Total	895,637	221,683	1,117,320
Total, 1911	881,002	215,236	1,096,238

It will be seen that the number engaged in the coal mines during 1912 was 97.5% of the total. To the number of persons given, those employed in quarries and openpit mining will have to be added. The coal output showed a decrease of 3.32%, but there was an increase of 2.06% in the number employed at coal mines.

An Automatic Ejector Set

A convenient ejector arrangement, for pumping in remote places, has been devised, and is being offered by the Penberthy Injector Co., of Detroit, Mich. The arrangement, illustrated in the accompanying engraving, will work automatically either with steam or water pressure, and at any reasonable distance from a source of steam supply. It will elevate about 20 ft. when operated with



AUTOMATIC EJECTOR

40-lb. pressure of steam or water, and with higher pressures will elevate to greater heights. Reference to the engraving will show the method of operation. The float *A* controls the opening and closing of the valve *B* by means of the intermediate levers *C* and *D*. The height of the water controls the movement of the bell, which may be so placed that it will close and open the valve when the water reaches a determined point. The pipe *E* delivers steam or water pressure and *F* is the delivery pipe. The strainer is shown at *G*.

The ejector should prove of value in handling water accumulations in remote sumps or other out-of-the-way places. If it is desired to raise the water to greater height than could be accomplished with one injector set, they may be arranged in steps.

A Use for Ruthenium is given in German patent 252,997, in which it is stated that at 450° C. and 80 atmospheres pressure, nitrogen and hydrogen in the presence of ruthenium or ruthenium compounds give a yield of 11 to 12% of ammonia.

Bailing through an Untimbered Shaft

By Douglas Muir*

SYNOPSIS—The Rayas main shaft in Guanajuato, Mexico, is circular, with a minimum diameter of 36 ft. About 150,000,000 gal. of water were bailed out in five months. The shaft was not timbered, so wire-rope guides were installed for the four bailers. Structures for water discharge and for handling ore were suspended in the shaft by stayrods.

Early in 1912 the work of unwatering the Rayas mine was begun by the Guanajuato Reduction & Mines Co., at Guanajuato, Mexico. It was decided to do this by bailing through the old Rayas main shaft. This shaft is sunk through the Guanajuato conglomerate hanging-wall formation, cutting the Veta Madre at a depth of 1265 ft. below the collar. It is circular in plan and has a minimum diameter of 36 ft., the usual diameter being 40 ft. The collar is lined with masonry, is octagonal in plan, measures 32 ft. 9 in. across from side to side, and rests on solid rock 50 ft. below the surface. This is well illustrated in Fig. 3. The work of sinking this shaft was begun in the year 1726 and it was not completed until about 1804. At some subsequent date a tunnel was driven for drainage purposes, cutting the shaft 269 ft. below the surface and this tunnel was chosen as the discharge point for the bailers. Where this crosscut reached the shaft, a gallery had been blasted out nearly circling it and leaving huge pillars in place with six openings to the shaft. These openings were used as discharge outlets for the numerous ox-hide bailing bags used in former years.

Fig. 1. Rays Shaft with Steel Sheaveframe and Gin Pole for Handling Bailers

Steel Sheaveframe Built Flush with Ground

At the time of beginning the work, the shaft was equipped with an old timber headframe. This was torn down and the flat steel sheaveframe shown in Fig. 1, put in its place. The steel sheaveframe is built of one 36-in. plate-girder, two 24-in. I-beams, and three 18-in. I-beams; all braced with 12-in. I-beams. The ends of the I-beams are let into the collar, their top surfaces flush with the ground. There was on the ground a 400-hp., first-motion, reel hoist, having a 60-in. stroke, with a maximum rope-speed of 1300 ft. per min. This hoist, built by the Union Iron Works in 1886, was overhauled and put into working order. A boiler plant of similar age, consisting of four 4x16-ft. boilers, was also brought into service. There was, at another shaft on the property, not in use, an old Fraser & Chalmers geared steam-hoist which was taken down and moved to the Rayas shaft. The steam-cylinder end was taken off, new pillow-block bearings cast for the pinion shaft, and the hoist electrified by coupling to it a General Electric 235-hp., 285-amp., 440-volt, alternating-current motor, running at 430 r.p.m. loaded, and equipped with an automatic accelerator switchboard. The rope speed of this hoist at load is 700 ft. per min. Fig. 2 shows the hoist being assembled. The buildings in which were housed the large steam-hoist and the boiler plant are seen in the background.

At the time of beginning the unwatering, the water-level stood 770 ft. below the collar of the shaft, leaving a depth of 495 ft. of shaft and workings to be unwatered. While the work of preparing these hoists was in progress, the small geared steam-hoist, situated in the house on the right in Fig. 1, was put into operation and a gig hung from it close to the side of the shaft as shown in Fig. 4. The surface of the water in the shaft was covered with floating wreckage, the result of timbers falling from above and also rotting off, becoming dislodged from the submerged stations and floating up from below. Many

*Assistant general manager, Guanajuato Reduction & Mines Co., Guanajuato, Mexico.

of these timbers were 16x16 in. in section and 20 to 25 ft. long. Men were lowered in the gig and these floating timbers sawed into suitable lengths for handling by the small hoist and pulled out, leaving the surface of the water clear for bailing. At the same time the work of equipping the water-discharge station at the crosscut level was well under way.

Backstops and Aprons Stayed with Iron Rods

Plumb lines were dropped from the sheaves of the two hoists to determine the exact plane of the wire-rope guides on which the bailers were to run. From the plane thus determined, the framework backstops *A*, Fig. 6, for receiving the kick-back from the bailers on discharging, and the apron decks for receiving and carrying off the water, were located, proper clearance for passing of the bailers being allowed. To support these structures, holes were drilled in the sides of the shaft and 1½-in. eye-bolts were wedge-driven and cemented into them. From these eye-bolts heavy wire cables were stretched across the shaft, and tightened by turnbuckles, thus giving a support on which to lash planks to work from. The timber frames *A* of 8x8-in. material were erected back of and parallel to the plane of each set of guides to form the backstops. These frames spanned the distance between the two outside guides and were 16 ft. high, allowing for a considerable error in overwinding so that if such occurred, the bailer would not swing back toward the center of the shaft and strike the top of the backstop on its return trip downward, as it might if the frame were low. These frames were suspended from heavy eye-bolts in the sides of the shaft 30 ft. above, thus giving a nearly vertical pull at the supporting points. On the faces of these frames were spiked blocks of wood and across these blocks were nailed 3-in. planks *B* to receive the blow of the discharging bailer. Clearances of nine inches were left between the back of the bailer and the face of these planks, and between the front of the bailer and the edge of the discharge apron, these small clearances insuring a minimum spilling of water. During rapid running, the swing set up in the guides often brings a bailer in violent contact with the planks. These are knocked off and no damage is done to the bailer, which would not be the case if a rigidly braced frame were placed close to the bailer and the rather loose planks not provided.

The discharge decks were built of 2-in. planks on a 6x6-in. frame hung from the side of the shaft, spanning the distance between the two outside guides and having a steep slope to carry off the water quickly. In Fig. 3, a photograph taken looking down the shaft at noon, a bailer can be seen arriving at the water-discharge 269 ft. below the collar. A discharge apron, both backstops, and a tripping weight on a rope guide above the bailer can be made out.

Eight Wire-Rope Guides for Bailers

The guides are ⅞-in. galvanized wire rope. The drums on which they were carried were placed near the shaft at the surface, the ends of the ropes passed through clamps to hold them, and the ropes laid out until the ends reached the discharge station 269 ft. down. The guides for each bailer are spaced 4 ft. 6 in., with a 2-ft. 10-in. clearance between inside guides of the pair electrically operated and a 3-ft. 5-in. clearance for the steam-operated pair, since the latter were longer and heavier bailers and had more movement when in action. Rocks weighing about a ton each were drilled for eye-bolts, clamped one to each guide end at the discharge station and swung out into the shaft. Two 8x8-in. timbers were notched to match the spacing of each set of four guides and clamped to them by bolts passing through the timbers as shown at *C*, Fig. 6. The notches for the middle guides were made large, to allow them with their weights to be lowered one at a time by sliding freely through the timbers. The two outside guides with their weights were clamped tightly to the timbers as a single unit.

The work of lowering the guides was carried out as follows: Each middle guide was clamped to a hoisting cable at a point below its sheave and lowered independently, sliding through the timbers kept hanging at the discharge station by the outside guides. When the end of the hoisting cable reached these timbers, the guide was made fast on the surface, the hoisting cable raised and the operation repeated until the two suspended rocks were about 115 ft. below the surface of the water. One hoisting cable was then unwound down the shaft and wound back on its hoist drum in the same direction as the other cable and the drums clutched in so as to have two cables to lower by at the same time. The hoisting cables were clamped simultaneously to the two outside guides, which

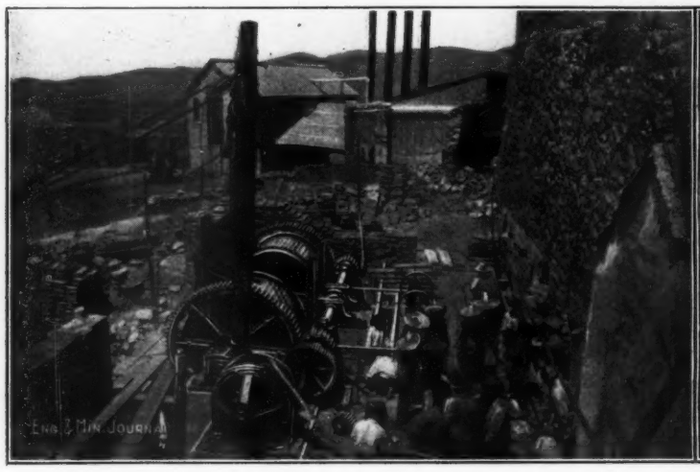


Fig. 2. Assembling Electric Hoist

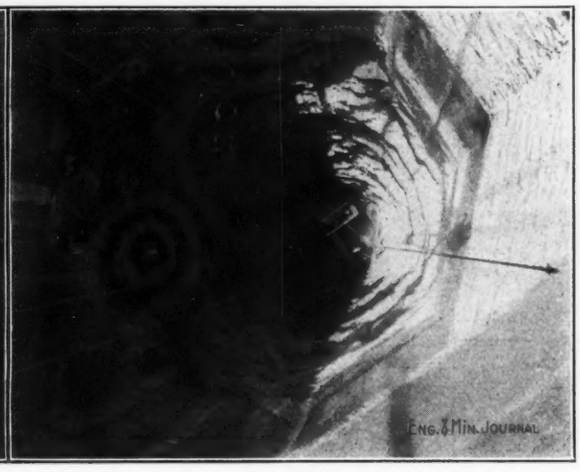


Fig. 3. Looking Down Shaft at Noon

were then lowered at the same time, in the same manner as described for the single guides. These guides were lowered until the clamping timbers were about 100 ft. below the surface of the water and 15 ft. above the rocks on the middle independent guides. When bailing had lowered the water-level nearly to the timbers, the guides were lowered another 100 ft. In lowering, the slack on the guides from their drums to the discharge station was handled and held by taking two wraps of guide cable around the hoist drum over the layers of hoisting cable already there.

Cylindrical Bailers of Sheet Iron and Wood

The bailers on the steam hoist have a capacity of 1015 gal. net and the electric bailers 575 gal. These bailers were built by native carpenters and, with slight improvements to increase the efficiency, are of similar design and construction to those which had been used in the camp for similar work. They are built of No. 14 galvanized sheet iron, riveted in the form of a cylinder, having heads and bottoms of double 2-in. plank, fastened in by large wood screws. They are bound with bands of ⅜x2-in. strap-iron for stiffening, and are slung on the hoisting cables by means of a harness of iron rods and a bridle as shown in Fig. 6. In this drawing, a bailer of each size is shown hanging at the discharge station, and below them the arrangement of rocks and spreader timbers as they appear under the water. The bottom of the bailer has a 12x14-in. hole cut in it for a water intake, over which is a hinged leather-covered door of mesquite. In the side at the bottom is a 10x10-in. hole to which is fitted a frame carrying a similar door *E* for discharge. The discharge door is connected by a ½-in. iron rod *F* to one end of a lever *G* mounted on top of the bailer. The other end of this lever is split and runs on the outside guide so as to engage the tripping weight *D* and effect the discharge. The tripping weight is a block of oak, slotted to fit on the guide, on which it slides loose, being hung from above by a small wire cable. In case the hoistman pulls by the discharge point, the weight is simply carried up along the guide and no damage is done to the bailer. The guide blocks for the bailers are of cast zinc, in two halves, held in strap-iron frames which are bolted to 3-in. wooden extension pieces. On the bottoms of the bailers are cones of ⅛-in. sheet iron perforated with 1-in. holes, sufficient in number to give an area exceeding that of the intake door. These cones do away with all jar as the bailers strike the surface of the water.

Shaft Unwatered in Five Months

A gin pole, mounted on the surface at the edge of the shaft, is shown in Fig. 1, equipped with block and tackle. It was afterwards fitted up with pulley and cable running to a geared winch. It was used for removing the bailers from the shaft for repairs, spare bailers being kept in readiness for instant changing.

The month of July was an average month on bailing work and the performance and the costs in Mexican currency for this month are given in the accompanying table. The steam hoist started bailing Apr. 8, and the electric, Apr. 20. The mine was unwatered on Sept. 15, after removing about 150,000,000 gal. of water. Four and a half months of rapid, continuous bailing accomplished the task, as the work of the first half month went slowly, due to having to break in a crew and overcome and remedy defects as they were encountered.

Permanent Hoisting Equipment Installed

Upon completion of the unwatering, the work of equipping the shaft was begun at once. The rock weights and bottom timbers were removed and the guides anchored well below the bottom station as shown at *A* in Fig. 7. At the surface, eye-bolts of 1½-in. iron, threaded for three feet for tightening the guides, were hung through plates on the head frame and the guides drawn tight with them.

An 11x11-ft. crosscut tunnel was driven from the grade of the mill electric railway, to pass by the shaft at a distance of 20 ft., thus allowing a full train of cars to pass the shaft. At a point opposite the shaft, a raise 8x15 ft. in section was driven for 30 ft., forming an ore pocket for delivering ore to the cars, and from the top of the raise a short crosscut 7x15 ft. in section was driven to cut the shaft. From the main crosscut, another small road was driven to the shaft for handling men and supplies. On breaking through, a timber platform was hung in the shaft in front of each connection point in order to catch the rock which otherwise would have fallen down the shaft and wrecked the discharge station, since this work was done while bailing was still in progress. Both entrances to the shaft were arched with cut stone laid in

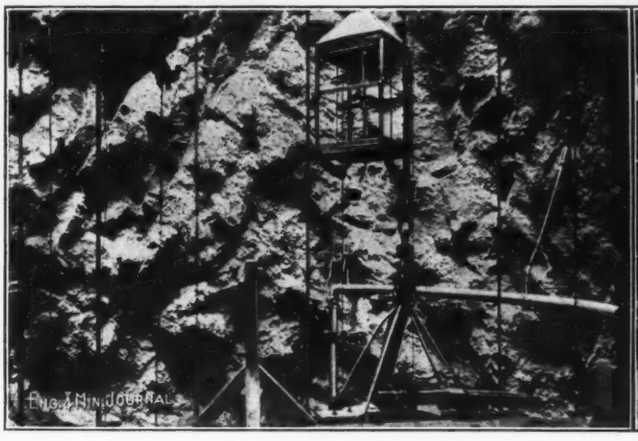


Fig. 4. Shaft Interior from Manway

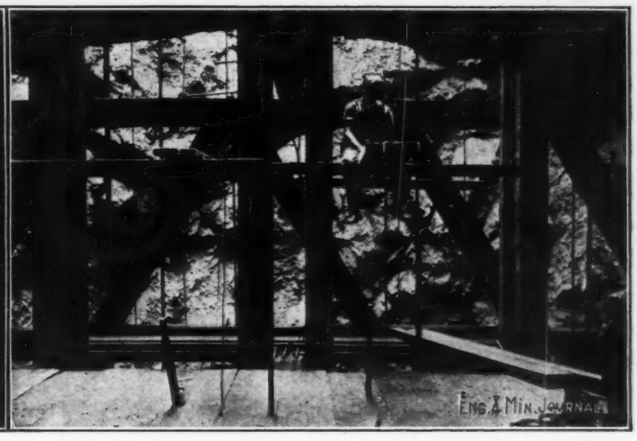


Fig. 5. Interior of Shaft from Ore Pocket

cement mortar. The shaft was equipped for hoisting ore with the electric hoist only.

Stations Partly Suspended in Shaft

In front of the crosscut to the top of ore pocket, a truss of 10x10-in. timber, shown in Figs. 5 and 7, back of the guides and parallel to their plane, was hung by 1¼-in. rods to the end points of the top and bottom chords. These rods had turnbuckles, and were fastened by plate clevises to 1½-in. eye-bolts placed in the sides of the shaft nine feet above the top chord of the truss. To the bottom chord 10x10-in. timbers were bolted and seated in hitches in the side of the shaft. On this structure were placed the rigid-frame guides, into which the cages run at landing, the chairs for landing, and the decking for the cars. In front of the manway opening, a platform was hung in the shaft extending to meet the edge of the cage.

Owing to the fact that the stations below were situated on the opposite sides of the shaft, it was necessary

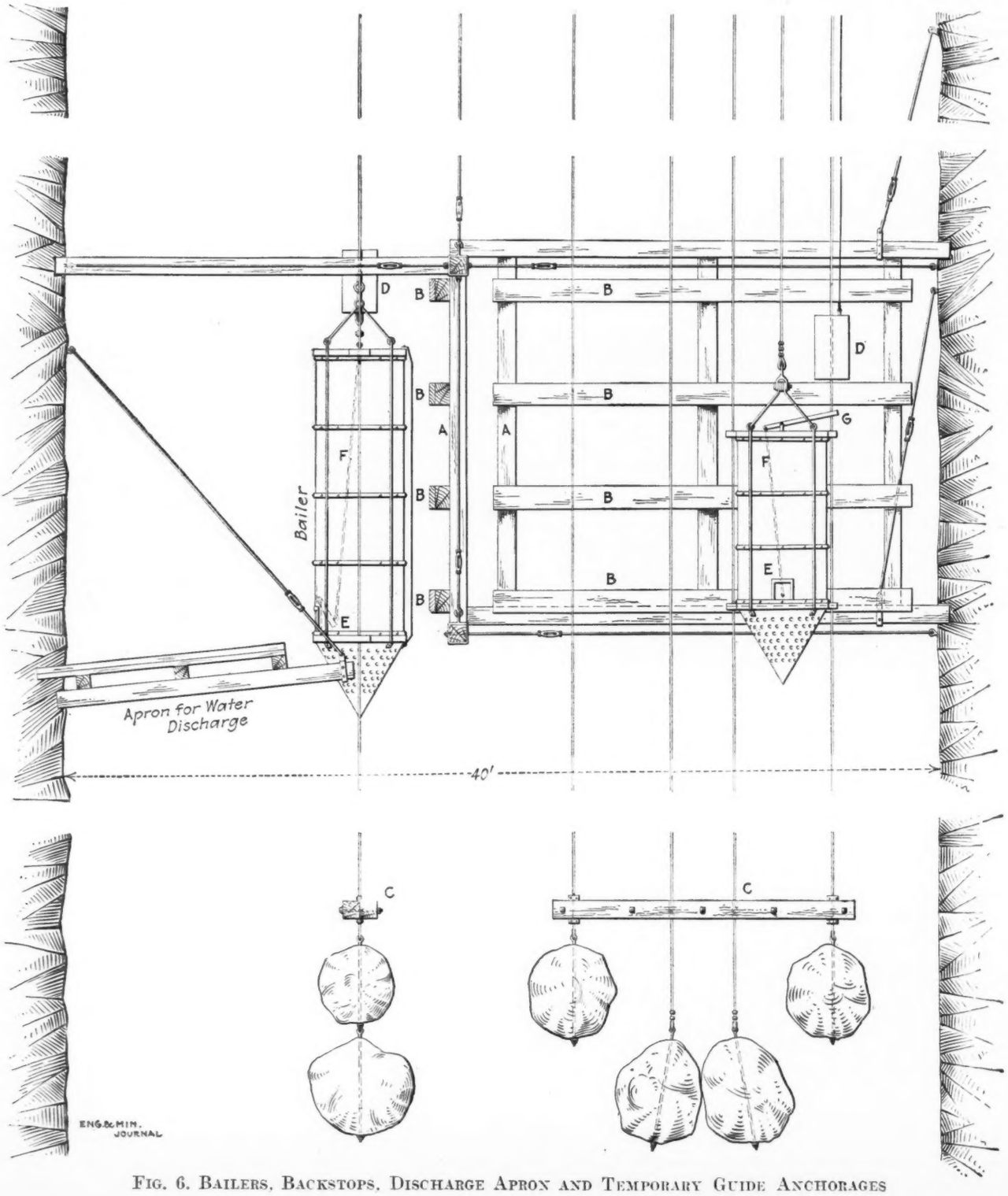


Fig. 6. Bailers, Backstops, Discharge Apron and Temporary Guide Anchorages

that at one of them the mine cars cross the shaft to reach the cage. Two trusses were hung in the shaft to form a bridge for tramming across to the cage, the cars entering the cage from one side and leaving it from the other. The trusses were hung similarly to the one described.

A 6-In. Pipe Line for Compressed Air

The compressor was set at the mouth of the electric railway crosscut tunnel. A 6-in. air pipe line enters the

AMOUNT OF WATER HOISTED IN JULY, AND COSTS

Water handled:	Gal.
Elec. bailer, 35.2 trips per hr., 575 gal. per trip	15,058,560
Steam bailer, 31.8 trips per hr., 1015 gal. per trip	24,014,088
Total	39,072,648
Per day	1,260,408
Average lift of water	568 ft.
Costs per month:	Pesos
Labor, operating, 55 pesos per day	1705.00
Labor, extra, lowering guides and tie-ups	100.30
Material and supplies, operating	1003.09
Electric power and coal	5252.92
Superintendent's and electrician's time	225.00
Shop work	203.28
Total	8489.59
Cost per gal.	0.000217

shaft through the manway on the railway level and continues around the side of the shaft to the point where the gig of the small geared steam-hoist hangs and thence down the shaft. The run-around of the pipe, which is well shown in Fig. 4, is supported on hook brackets. For conveniently handling the pipe in lowering and connecting, an extra sheave was mounted on the headframe over

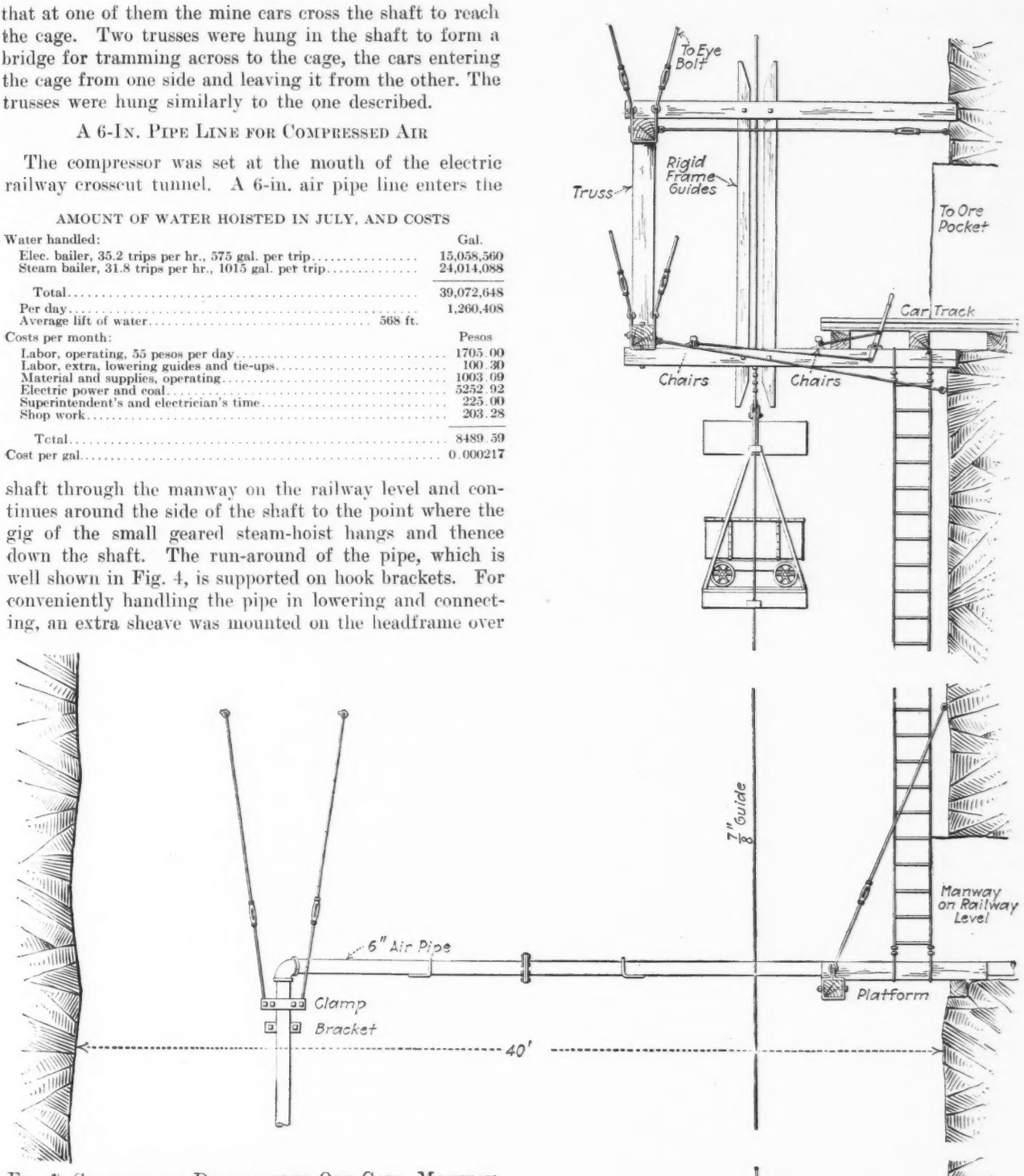


Fig. 7. Station for Discharging Ore Cars, Manway Station and Permanent Anchorage for Rope Guides

the vertical stretch of the pipe. The pipe was screwed together in sections of two lengths each, and these sections lowered with the cable from one drum of the electric hoist passed over this extra sheave. The work of coupling and hanging was done from the gig. The pipe was hung from rods and supported against brackets on the side of the shaft to give alignment. The brackets were made of two 1¼-in. rods, wedge-driven and cemented into holes in the rock with semicircular plates of

1x3-in. strap-iron clamped to them, against which the pipe bears. Vertical support was given by 1x3-in. clamps, just above the brackets, held by two 1¼-in. rods from 1½-in. eye-bolts. Each rod has a turnbuckle for equalizing the load. Hangers and brackets are spaced 100 ft. The eye-bolts are placed 15 ft. above the clamps to give a large component of pull along the line of the pipe and the rods are fastened to the eye-bolts, by plate-clevis devices to facilitate handling and comparing in the shaft.

Electric Iron Smelting in Norway

Electric smelting of iron ores in Norway has not proved a success, according to the *Iron and Coal Trades Review*, Apr. 11, 1913, which says:

It has come as an unpleasant surprise to the Norwegians that the Hardanger Electrical Iron & Steel Works has shut down after having been in operation about nine months, and further, that the Arendals Fossekompani has given up the idea of proceeding with the construction of its projected iron and steel works. The decision to shut down the Hardanger works was taken at a recent general meeting. The company resolved to transfer the 14,000 electrical horsepower which it had at its disposal to a French group of financiers, who intended to establish a new industrial concern, for which this electrical power will be used. . . .

As regards the Arendals Fossekompani, few details are available about the financial position, but it is known that the company has disposed of the electrical energy which was to be used for the iron and steel works for other purposes, and there is thus no reason to believe that the shareholders are going to fare much worse than those of the Hardanger works, the more so as the Arendale Fossekompani was able to take advantage of the experience gained at Hardanger, and to withdraw in time. It may be observed that it was mentioned in the prospectus that the company, which intended to employ the same process as at Hardanger, would be able to get all necessary information as to practical working. The erection of iron works, however, has not been abandoned, but only postponed. The company has still sufficient electrical power in reserve for this purpose, and has lately secured one waterfall of 4000 hp. and another of 12,000 hp.

The process adopted and used at the Hardanger works was that of the Elektrometal Co. In view of the experimental character of the tests carried out at Domnarfvet, there was some reason to presume that the figures previously given might be improved upon in furnaces of a larger type, and that 3 tons per horsepower per year, which was the real goal, would ultimately be reached. It has, however, now turned out that a great mistake has been made in Norway, where there is no charcoal available, in taking a somewhat too sanguine view of the prospective improvements. During the working period at Hardanger it soon became evident that the furnace could not nearly be brought up to such an efficiency as was anticipated. The Elektrometal Co. was informed of this, and sent its representatives to Hardanger. Some alterations were suggested, and, in fact, every possible means was tried in order to get over the difficulties, but in vain. The producing capacity gradually decreased instead of increasing, and the quality of the pig iron became less uniform. The company then appointed a committee of Norwegian engineers with a view of getting their opinion on the situation. Their view was to the effect that work could not be continued on a remunerative scale as the conditions were at the present time, with high prices of raw materials and with high freights, even if the producing capacity were to be increased considerably.

The results from the working of the newly erected 12,000-hp. furnace at Domnarfvet, which will be available in the early part of the summer, may turn the scale. But apart from this there is a Norwegian process now employed at the Tinfos Iron Works.

These experiments with electrical smelting of iron ore were started in 1909. The method was gradually improved, and gave such promising results that it was decided to form a company with a capital of £55,555 for the exploitation of the process. This was done in December, 1910, and the Tinfos Iron Works came into existence. The amount of electrical energy to be employed for the iron works was 10,000 hp., of which 5000 hp. have now been harnessed, sufficient for the working of three furnaces. The first of these was completed at the end of September, 1912, while the other two were approaching their completion. The production of the first furnace amounted to 10 tons of electrical pig iron per day of 24 hr. A smaller furnace has been in operation at the Ulefos Iron Works, where 300 tons of electrical pig iron were produced last year.

The Platoro District

The accompanying map shows that part of southern Colorado in which the recent discovery of gold ore was made at Gilmore. There is said to be a mineral belt extending from Summitville to Platoro. The Gilmore discovery was made by a prospector named Gilmore who found ore between the two towns. He notified friends in Cripple Creek of his find so that the ground was well staked around the discovery claim before outsiders heard

MAP OF THE PLATORO DISTRICT

much about it. A road is now being opened along the Alamosa River to afford access to the region. This road had been washed out in 1911 by floods.

Tube-Mill Liner

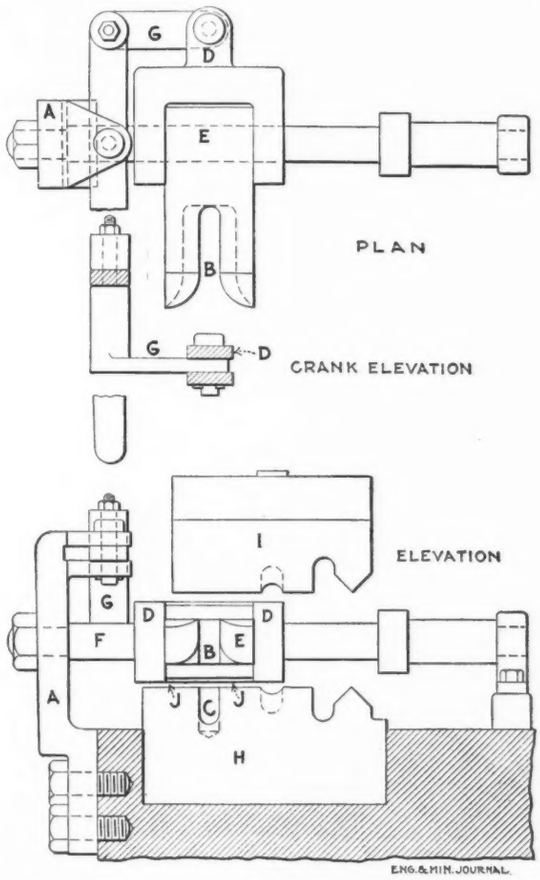
Another tube-mill liner is the subject of U. S. pat. No. 1,055,395, which has been granted to Alexander R. Globe, of Cobalt, Ont., Canada. This liner appears strikingly similar to the well known El Oro type. It consists of a series of iron plates forming the lining of the tube, and these plates contain channels for holding pebbles, similar in effect to those of the El Oro liner. These channels are circumferential instead of longitudinal, as in the El Oro type, this being the most notable difference. The channels are made wedge-shaped, a feature which has been made use of in other instances. The wedges are diminishing in size in the direction of rotation of the tube so that the effect is to wedge the pebbles tightly into the lining.

Advance in Water-Turbine Construction has been rapid in the last few years and must be largely credited to the United States. By empirical methods, greater and greater efficiencies have been obtained. In the "Eng. Record," Mar. 29, 1913, there is a description of a new and extremely efficient installation of water turbines and generators for the Appalachian Power Co., on the New River, Va. The turbines operate under a 49-ft. head at a speed of 116 r.p.m. and are rated at 6000 hp. each. They require each about 1200 sec.-ft. of water at full load. Careful tests showed that at maximum efficiency, 93.7% of the power in the water was developed by the wheels.

DETAILS OF PRACTICAL MINING

Fuller Attachment for Machine Sharpener

Fullers for working down the wings of the machine steel are in use on the sharpening machines of the Champion mine at Painesdale, Mich. They are of especial advantage in forming new bits, but also accelerate the sharpening of the dull bits. The fuller is arranged on the sharpener, so as to be thrown in or out as required. In use it occupies a position between the two dies of the vertical hammer. This results in shortening the stroke so that the blows are lighter and the danger of working down the wings too thin is decreased.



ATTACHING FULLER TO DRILL-SHARPENING MACHINE

The construction of the fuller and the general arrangement of the assembled shifting mechanism is as illustrated, the elevation being a view looking along the axis of the steel. The bit is inserted so that one vertical wing is in the recess *B* of the fuller proper *E*, and one is in the recess *C* of the specially adapted lower die *H*. The wings to be flattened lie at *JJ*, between the lower die and the fuller. The upper die *I* has a flat portion on the bottom to work on the top of the fuller and transmit the hammer blows to the steel. The fuller is pivoted in a holder *D*. Both holder and fuller slide on the pin *F*, this motion being effected by a crank and a shifter, working in the bracket *A*. The bracket is bolted securely to the frame. A rest *G* is inserted under the fuller. The device is the idea of James Treganza, foreman of the Champion blacksmith shop.

Method of Calculating Size of Hoisting Rope

A convenient formula is presented by A. W. Brown, in Appendix V of a paper entitled "Electrically Driven Winding Engines in South Africa," (*Trans.*, North of England Inst. of Min. and Mech. Eng., Vol. LXIII, Part 1). The sectional area of steel in any rope is nearly independent of methods of construction. It is expressed in Table I. There is a length of rope, constant practically for all diameters, which will be just self-supporting. It can be calculated from Table I and manufacturers' tables of weight per unit of length. It will vary with the quality of steel and method of construction. It is for rope constructed of six strands of seven wires each, 16,100 lb.; for ropes of six strands of 19 wires each, 14,700 lb.; and for ropes of six strands of 37 wires each, 14,400 lb. These figures are for 100-ton steel. For other qualities the length should be divided by 100 and multiplied by the strength in tons per square inch of the steel in the rope in question. If this length be divided by the desired safety factor, a length is obtained which will be self-supporting within the limits of the factor; and if from this length the depth of shaft is subtracted, the remainder represents the length of rope, which should equal the total weight of the load to be hoisted. If the total weight to be hoisted be divided by this length, the weight of rope per unit is obtained and the requisite diameter can be got from manufacturers' tables. This may be expressed in a formula as follows:

TABLE I. ACTUAL STEEL SECTION IN ROPES OF VARIOUS DIAMETERS

Rope diameter, in inches.	½	¾	1	1¼	1½	1¾	2	2¼
Square inches of steel....	0.092	0.201	0.37	0.61	0.85	1.14	1.48	1.9

TABLE II. LENGTH OF ROPE, IN YARDS, GIVING A STATIC STRESS EQUIVALENT TO THE BENDING STRESS

Ratio of Pulley Diameter to Rope Diameter	Type of Construction: 6 Strands 7 Wires per Strand	6 Strands 19 Wires per Strand	6 Strands 37 Wires per Strand
30	3360	1940	1370
40	2520	1450	1025
50	2015	1160	820
60	1680	970	685
70	1440	830	588
80	1260	726	514
90	1115	645	455
100	1010	580	410
110	915	530	372
120	835	482	342
130	775	445	316
140	714	415	294
150	670	388	273

$$\textit{Pounds per yard} = \frac{\textit{Total weight on rope}}{1610 - \textit{depth in yards}}$$

assuming a safety factor of 10, steel breaking at 100

tons per sq.in., and a rope of six strands, seven wires each. A more satisfactory formula involves the bending stresses, which may be taken from Table II, giving then the following formula:

$$W = \frac{G}{\frac{L \times S}{100 \times F} - Y - B}$$

where

W = Weight of rope in pounds per yard.
G = Total weight on end of rope in pounds.
L = Length of rope just self-supporting for 100 tons per sq.in. steel.
S = Ultimate strength of steel to be used, in tons per sq.in.
F = Factor of safety.
Y = Depth of shaft in yards.
B = Value of bending stress taken from table.

In using such a formula a lower safety factor is not only permissible, but necessary, as the bending stresses are included in the calculation and do not have to be covered by the factor of safety, better called the factor of ignorance.

Fusible Signal Plugs for Air Compressors

The Hodges fusible signal plug which is being placed on the market by the Ingersoll-Rand Co., New York, is devised to give warning of a rise in temperature above a point which has been previously determined upon as the limit of safety. Thus it may guard against the development of excessive strains or other dangerous conditions.

This device consists of a body formed for screwing into a hole tapped for a ¼-in. pipe thread in the wall of the apparatus to be protected, an ornamental cap and a removable stem containing the safety element. As there are no movable parts, no attention is required from the operating engineer.

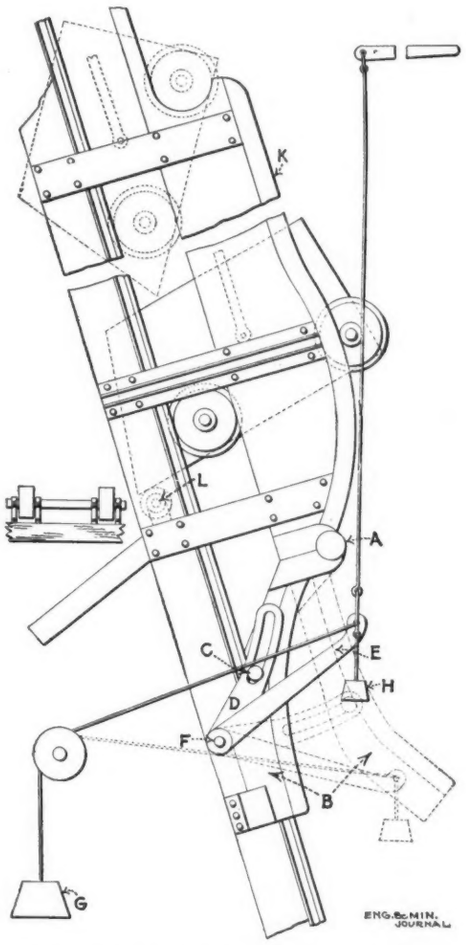
The plug can be placed in the discharge space of a single-stage compressor, in the high-pressure side of a two-stage compressor, or in a receiver or other air container, where, if an excessive rise of temperature occurs, the safety element melts and opens a minute passage through the stem to the head, allowing a small amount of air to pass, producing a distinct whistle that cannot be overlooked by anyone in the vicinity. This will continue until measures are taken to remove the cause of the trouble. It is then but a moment's work to replace the plug with a new one and the machine is again protected.

These signal plugs are supplied in two types, with 350° and 500° F. blowing points, respectively. The 350° plug is suitable for use in the discharge pipe of a single-stage compressor working at 40 lb. gage pressure; in the discharge side of a two-stage compressor working at 100 lb., or in the discharge side of a three- or four-stage compressor, delivering air at 100 lb. The 500° plug is for use in the discharge pipe of a single-stage compressor working at 100 lb. pressure.

Changeroom Lockers in German Collieries Are Being Abandoned, according to George S. Rice, speaking before the New York Section of the American Institute of Mining Engineers, and their place taken by anchors on which the clothes are hung and then raised nearly to the ceiling. Each miner has his anchor and there is a lock on the rope or chain by which it is raised and lowered. Security is thus obtained, and as the rooms are built high, excellent ventilation is secured.

Angove Skip Dump

The skip-dumping device for inclined tracks invented by John Angove and used at the Copper Range shafts, differs from the ordinary type of dump in having no break in the main rails. Instead of the front wheels of the skip falling away on the bent-over main rails and the rear wheels continuing up on auxiliary rails in the original direction, the front wheels continue in the original direction and the rear wheels are elevated on auxiliary rails until the skip assumes a dumping position. A great advantage of the dump lies in the fact that it can be applied to dumping in underground bins or can be used for more than one dump in the surface bins when it is desired to hoist both waste and ore. Also, it can be arranged to intercept a skip falling back from a broken rope after an overwind.



SKIP DUMP FOR INTERMITTENT SERVICE

Referring to the drawing, the skip is shown in dumping position and the action of the auxiliary tracks is apparent. They are brought down outside the main rails and the wider treads of the rear wheels are engaged by them while the narrower front wheels pass through. The connecting point B of the auxiliary outside rails can be permanently fastened to the lower track so that any skip passing is forced to dump, or it can be hinged at A, as shown in the drawing, in which case the dump can be made operative or not, as desired. When open, as shown in the dotted position, the skip is allowed to pass

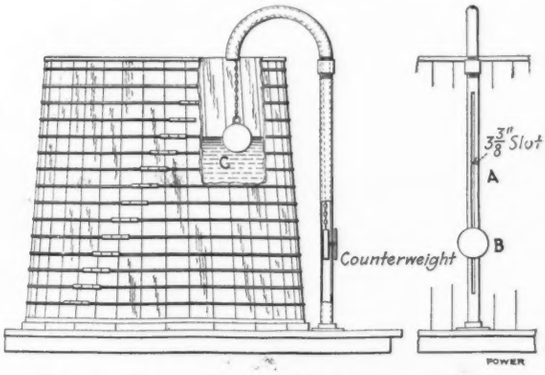
through. The movable point *B* has a stud *C*, which plays in a slot in the rocker-arm *D*. This rocker-arm and another one *E*, are attached to the rocker-shaft *F*. By depressing *E* through the connections shown, the switch point *B* is opened, and by raising it is closed. The two counterweights *G* and *H* make the movement of the operation relatively easy. Inasmuch as no shafts can extend across the track where the skip runs, a certain portion of this mechanism must be repeated on the other side.

At the upper part of the auxiliary tracks, a pocket is cut in the supporting plate, which is designed to catch the rear wheels of a skip and prevent its descent into the shaft if the rope should break for any reason. The guard rails *K* are provided to keep the rear wheels in their proper position.

At the top of the chute, in such a position as just to catch the mouth of the dumping skip, are the rollers *L*, which prevent the front end from falling down and binding against the chute. When a long skip is used, the hanging, opposite an underground dump may have to be cut away to get room.

Water Level Indicator

Indicators for the purpose of showing the water level in tanks are comparatively simple to install, but many types are open to the objection that in a cold climate they



Water-Level Indicator for Roof Tank

are interfered with by water freezing on the chain connecting the float with the indicator hand. A protected type which should overcome this objection is proposed by Harry Biehl, writing in *Power*, Feb. 11, 1913. The indicator, as illustrated, is made of 2-in. pipe in the form of a return bend of about 2-ft. radius. A slot *A* is cut in the straight pipe, and in it a pin carrying the tin plate *B* slides, with the rising or falling of the water level. This tin plate is connected with a chain that runs inside the pipe, and at the tank end is connected with the float *C*. Such ice as forms acts as a lubricant for the movement of the chain in the pipe.

A Drafting Kink

By H. W. Faulkner*

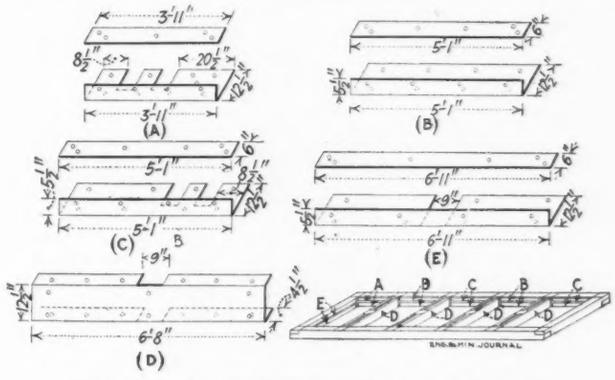
When inking-in or tracing a number of lines which cross each other within a space of a few inches, the loss of time, necessitated by waiting until one set of lines dries before tracing the other set, can be avoided by the following simple method.

After inking-in the vertical lines of a shaft, for example, some fairly thick object such as a triangle or straight-edge, is placed as near as possible to the figure to be drawn. A second triangle or straight-edge is placed on the first one so that it can be moved into position for drawing the horizontal and other lines of the figure. The upper triangle should not project more than an inch or two, unless it is extremely rigid, as the bending from a too large overlap may cause smudging.

*Chief engineer, Mexico Mines of El Oro, El Oro, Mex.

Blasting Irons for Shaft Sets

In sinking the No. 2 Hancock shaft in the Lake Superior copper country, no cover platform was used for storing the machine drills and protecting the lower set of timbers from flying rocks at blasting time. All the drilling equipment is raised to the 34th-level station at blasting time. Blasting irons, the details of which are shown in the accompanying illustration, are used to protect the bottom timbers from being cut by flying rock. These are made of ¼-in. iron plates, and are punched with ¾-in. holes, so that they can be fastened to the timbers with railroad spikes. Set *A* is for the wall plate in manway compartment, and the timbers are cut away for the hanging bolts on the under side. One piece of the manway iron goes clear under the wall plate and half way up the side, while to cover the other half of the inside space a separate piece is spiked on. All the other irons for the wall plate are similarly designed, but two other sets are needed; one pattern for the two compartments in which there are no hanger bolts, and the other for the two compartments in which the hanger bolts are used.



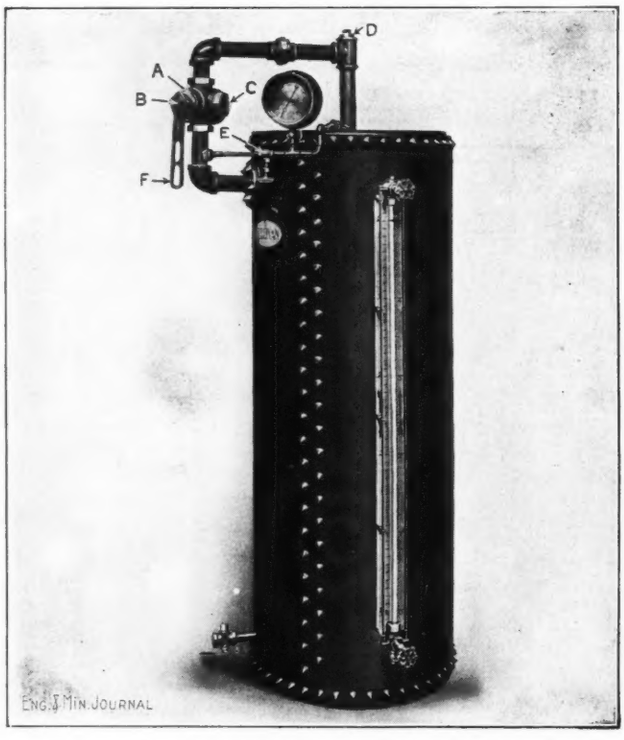
Blasting Irons Used in Hancock Shaft

The blasting irons for the end plates are similar to those for the wall plates, except that they are cut away on the under side to straddle the guides and studdles. These irons are also spiked to the timbers. The blasting irons for the dividers are made in halves, each of which covers one side and half the top and bottom. The halves are put on the timbers and then held together by two clamps, which are also cut away to straddle the guides and studdles. If it is preferable, the divider blasting irons may be fastened on by spikes like the others. Spiking is preferred for the blasting irons on the end and wall plates, owing to the blocking, and when the ground is bad they cannot conveniently be attached by clamps.

Compressed Air Measuring Tank

In the JOURNAL of July 6, 1912, appeared a description, by George H. Gilman, of a displacement-tank apparatus for measuring air consumption of rock drills. The following is a description by F. D. Holdsworth in *Mine and Quarry,* April, 1913, of a somewhat more compact and satisfactory apparatus for accomplishing the same purpose.

Instead of employing two separate tanks, this meter, as shown in the accompanying photograph, consists of one tank with an inner shell. The body of the meter is a strong steel shell good for a working pressure of 110 lb. The interior space is divided into two compartments by means of an inner cylindrical shell, located concentrically with the outer shell and flanged and riveted at the top to the top head of the outer shell. Its lower end terminates about three inches above the lower head of the outer shell and



TANK WITH INTERIOR PARTITION FOR MEASURING COMPRESSED AIR

allows for a free flow of water in and out, without producing waves or surges in the water which would make the gage readings unreliable.

The air expelled from the meter is measured by the fluctuation of the water level in the annular space between the shells. By means of the four-way valve *A* air is admitted, for example, to the inner chamber, forcing the water downward and into the outer chamber. The rising water in the outer chamber forces the air out of this space through the four-way valve into the pipe leading to the machine under test. The reversal of the four-way valve admits air to the outer chamber, forcing the water downward back into the inner chamber, where the rising water again forces the air above it into the pipe leading to the machine under test. By manipulation of the four-way valve so that the water column reciprocates between the top and bottom zero marks on the scale, the test may be continued for any desired length of time.

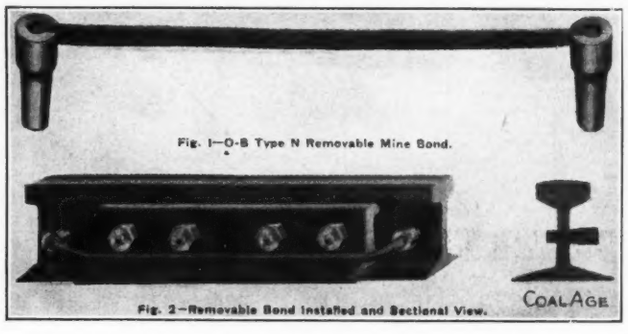
The tank should be set on supports which are sufficiently firm to insure freedom from vibration. In case the air supply is subject to considerable variation in pressure, a uniform pressure may be obtained by placing a reducing valve in the supply pipe connected with a small receiver of about eight or 10 cu.ft. capacity, situated in the pipeline between the reducing valve and the four-way valve, to relieve the former from sudden changes in pressure.

Before beginning a test the tank should be filled with water through the plug *D* until the water level shows about midway between the ends of the scale. While filling, the equalizing valve *E* should be open, thus connecting the outer and inner chambers, equalizing the air pressure and insuring that the water level is the same in both chambers.

In freezing weather the tank should be drained after use by means of the drain cock. If desired, the tank may be filled with kerosene or other nonfreezing, noncorrosive liquid. The maximum capacity of this hydraulic meter, which is manufactured by the Sullivan Machinery Co., is 400 cu.ft. per min. at 100 lb. gage pressure. The tank weighs about 785 pounds.

Removable Rail Bond

In a mine employing electric haulage where it becomes necessary to use temporary track, the removal of the fixed bonds becomes a source of expense and annoyance. A bond which is easily inserted and removed has



BOND FOR TEMPORARY ELECTRIC HAULAGE TRACK

been designed by the Ohio Brass Co. to meet such conditions. As shown in the accompanying illustration from *Coal Age,* Feb. 1, 1913, the bond consists of a flexible copper cable soldered into tapered steel terminals, the whole being tinned. In using it, it is necessary only to bore holes in the rails with a standard 5/8-in. drill and drive in the terminals with a few taps of a hammer. The bond is made long enough to pass entirely over a fishplate.

The Electrical Conductors in Shaft Cables are often made of the sector or clover-leaf section. Since these shapes fit together, they afford a considerable reduction in amount used of insulation, external armoring and lead, for cables operating below 1000 volts. For higher presures the saving is less apparent, according to E. Kilburn Scott, in a paper read before the Association of Mining Electrical Engineers, of England, Feb. 7, 1913, and with high voltages, electric stress at the corners of these sections is appreciably higher than in conductors of circular section, and consequently more insulation is required.

DETAILS OF METALLURGICAL PRACTICE

A Convenient Rule for Pipe Sizes

L. B. Lent, according to *Eng. News*, gives the following: The velocity of flow in water pipes is very commonly taken at 3 ft. per second. This does not produce excessive friction loss even in comparatively small pipes. With this velocity: Diameter of pipe (in inches) is equal to the square root of the quantity of water flowing (in cubic feet per minute).

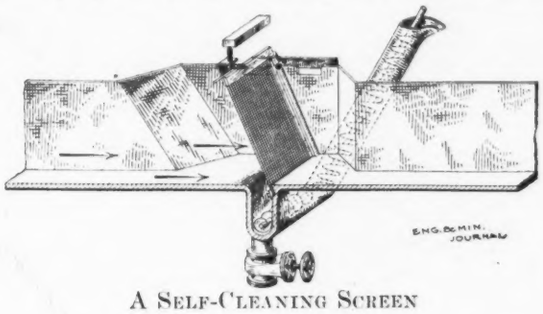
The rule is not exact, but involves an approximation of something less than 1%. The rule, of course, merely expresses the relation between area, velocity and volume of flow, and involves no hydraulic relations or laws.

The rule can be used with gallons per minute after dividing by 7.5 (more exactly 7.48) to get cubic feet per minute. It can be used with a velocity of flow other than 3 ft. per second by first solving the problem for the 3-ft. velocity, then dividing by the square root of the correct velocity and multiplying by the square root of 3.

❋

A Screening Device

A device intended to handle large quantities of material has been invented by G. H. Stanley, of Johannesburg, Transvaal, and he has been granted U. S. pat. 1,039,206 covering it. The device is substantially the placing of a vertical or slightly inclined screen in a launder or other pulp-conveying sluiceway and arranging mechanical means of bumping or vibrating the screen and causing the oversize to drop away from it by gravity. The illustration shows an application of the principle and also means for removing the oversize, either with an elevating screw or a rock. The mechanism shown at the top of the screen is for imparting the bumps or vibrations. The principle may be also applied to hydraulic classifiers.



A Self-Cleaning Screen

❋

Factory Floor of Boiler Tubes

An uncommonly good floor for the upper story of a factory can be made from old boiler tubes, says H. K. Scholefeld, in the *American Machinist*. We built such a floor some years ago that has given splendid service ever since. The method of construction was as follows:

A quantity of 4-in. boiler tubes 18 ft. long were laid down side by side, supported only at the ends. About 2 in. were left between each pair of tubes. Some planks were placed beneath the tubes to retain the concrete while setting. The planks were made to touch the underside of the tubes without lifting them off their supporting joists.

A rich concrete was poured over the tubes, and found its way between and around them; this was laid to a depth of 2 in. above the tubes. Afterwards, the planking was taken down, which left a floor remarkable for its lightness, strength and elasticity.

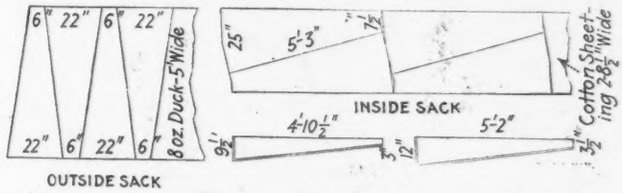
❋

Handling Cyanide Precipitate at Lluvia De Oro

By H. R. Conklin*

As explained in a previous article[1] on the practice at the mill of the Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex., zinc-shavings precipitation is giving way to the zinc-dust method. The latter has proved much more satisfactory, since experience has enabled the correction of faulty operation. The substitution of a centrifugal for a triplex plunger pump has also been of advantage.

The emulsion of zinc dust and solution produced in the centrifugal pump is filtered through a press, as in the usual practice, but additional capacity was required, and a system of sacks is now used, which is proving satisfactory. After many experiments the sacks are being made double, with the outside sack of 8-oz. duck, and the inner sack of plain cotton sheeting. The inner sack is made larger than the outer sack, so that it does all the filtering, while the outer sack takes all the pressure. Sacks are made tapering, and by using the patterns as shown in the accompanying sketch, are cut from the cloth without any waste. Inner sacks are sewed on a regular household sewing machine, and outer sacks on a heavy belt-stitching machine, with heavy linen cord. Both are sewed by doubling over the edge and sewing through the four thicknesses. Inner sacks are placed inside the duck sacks by means of two long slender sticks similar to a pair of shears, and are carefully spread so that when solution is turned on, the inner sack immediately fills out against the outer sack, without any spaces between.



Patterns for Making Filter Bags for Cyanide Precipitate at Lluvia De Oro

Each of two sets of sacks is about equivalent to a large press in capacity, and consists of 44 sacks, suspended

*Manager, Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex.

[1]"Eng. and Min. Journ.," Mar. 15, 1913.

from ¾-in. pipes, which are tapped into 4-in. pipe headers and spaced 8-in. centers. The two 4-in. pipes are suspended about eight feet above the floor, with centers about 10 in. apart, and each sack connection to the header consists of a short ¾-in. nipple next to the header, with a valve, nipple, union, nipple and sleeve below. Sacks are tied at the top with heavy linen twine, the inner one first, and the outer over it, the sleeve on the lower end of the pipe serving as a shoulder to prevent the sack slipping off when under pressure.

Underneath each set of sacks is placed a flat pan or launder on a slight grade, which catches all the dirt and is piped to the barren-solution tank. Each sack holds about 50 lb. of precipitate when taken off, and costs less than 50 cents.

BAG PRECIPITATE FILTER, LLUVIA DE ORO

In operation, two, three or four sacks are replaced each day, and precipitation is not stopped for cleaning up. The cycle of a sack is about 11 days. Beginning when its valve is opened, the flow of solution is rapid, but after the first day, becomes much less. After its valve is closed, it is allowed to hang one day and dry, and is then disconnected at the union and taken down. The binding twine is cut, nipple washed, and a new sack tied on, ready for work. The filled sack is set in the strong room for a few days to dry farther, and is then cut open, when the precipitate is in a hard cake. The sacks are burned in the electric furnace when melting precipitate, so that there is no loss.

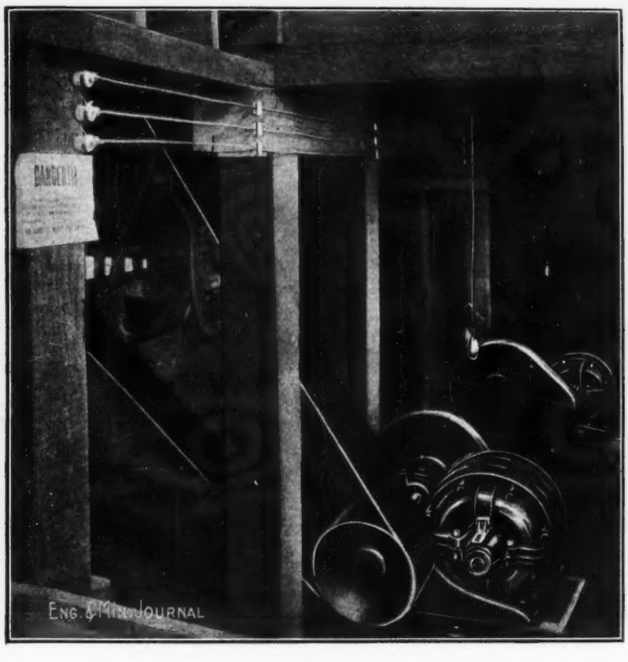
Regulation of the amount of solution precipitated is obtained by using any desired number of sacks. Contact of the precipitate with air has no effect, and if zinc dust is properly fed, all precipitation has occurred before filtering, so that the efforts of some managers to prevent air entering the precipitate press seem entirely unnecessary. Either in a press or in these sacks, the precipitate builds up from the bottom, and an excess of zinc, once placed in the filter, has no further appreciable effect in precipitation.

The only advantage of the press is that the precipitate is locked and safe against fire, but sacks could just as well be placed in a fireproof, locked room, or isolated building, and in every way are more satisfactory than the press.

Geared Motor for Stamp-Mill Drive

A motor for driving stamp mills has been recently placed in use. It has several features which make it valuable for the hard work and unfavorable conditions which attend stamp-mill service.

The motor is mounted in a cradle, which in turn is mounted on a heavy base-plate. The cradle carries a back shaft, to which the motor is geared. The back-shaft pulley runs at slow speed, so that it can be belted directly to the bull wheel of the stamp mill, thus eliminating the jack-



SPECIAL MOTOR FOR STAMP MILLS

shaft and saving space, belting, the loss of power due to belt slippage, and the expense of the jackshaft.

The pulley is outside the bearing on the cradle, so that the belt can be easily removed. The motor, gear and pinion can be removed without disturbing the line-up of the pulleys or handling the belt. The back-shaft bearings are split and can be inspected or renewed after merely slackening the belt. The gears are inclosed in a dust-proof case and run immersed in oil.

This installation can be supplied for driving mills of from 3 to 20 stamps, with stamps weighing from 800 to 1250 lb. One motor is ordinarily used for each battery and is shut down when the battery is not in use, thus avoiding a waste of power. It is a product of the Westinghouse Electric & Mfg. Co.'s shops.

THE COST OF DOING THINGS

Phelps, Dodge & Co., Miscellaneous Costs

The following data are given in the 1912 annual report of Phelps, Dodge & Co.:

At the Copper Queen Consolidated Mining Co.'s mines, Douglas, Ariz., it is stated that a more thorough exploring of the orebodies in advance of mining has not only allowed the production to be greatly increased but also permitted more economical methods of mining to be planned before stoping. One result of this has been a lowering in the consumption of timbering from 16.6 ft. per ton of ore in 1911 to 14.9 ft. in 1912. A table giving the average number of miles trammed per car shows that the average by hand was 229 miles, by mules, 646 miles and by electric locomotives, 2669 miles per car. The cost of the hospital department was $81,102 and a credit balance of $8952 was left over receipts from fees from employees after crediting $10,590 received for treatment of outside cases. In the converter department 27.77 tons of bullion was made per stand per day. During the year 6970 samples were made from 352,547 tons of ore.

At the Detroit Copper Mining Co., Morenci, Ariz., it is stated that the increase in wages raised the cost of mining 10c. per ton of ore mined. The following drop of 7% in the efficiency per man per shift as shown is attributed to a new 8-hr. law which reduced the actual working hours to 7.5 per shift:

	Tons of Ore Mined	Shifts Stoping	Tons per Shift
Jan. 1 to May 31, 8-hr. shift	219,220	55 479	3.951
June 1 to Dec. 31, 7.5-hr. shift	300,412	81,942	3.68¢

A gradual reduction in the consumption of timber per ton of ore is shown in the following table, due to the introduction of the slicing and caving system in 1907:

1906	17.518 feet b.m. per ton ore	Square setting
1907	15.536 feet b.m. per ton ore	Square setting
1908	17.422 feet b.m. per ton ore	
1909	14.378 feet b.m. per ton ore	
1910	12.806 feet b.m. per ton ore	
1911	9.773 feet b.m. per ton ore	
1912	9.748 feet b.m. per ton ore	

According to the average number of employees reported and the tonnages obtained from the various statements of the Detroit Copper Co., the following figures on the tonnage per man per annum may be obtained: In the mining department 941 men were employed and the ore mined amounted to 517,978 tons, which gives an average of about 555 tons per man per year. At the concentrating plant 501,928 tons of ore were reduced to 70,438 tons of concentrates, with an average of 148 men, which is equal to about 3380 tons of ore, or 475 tons of concentrates per man per annum. The total amount of material handled in the smelting and converting department was apparently 191,717 tons, including coke which with an average of 148 men would indicate approximately 1290 tons of material handled a year per man. The mechanical department employed 144 men and miscellaneous departments, 33, a total of 1414 men for all departments. The total production amounted to 24,802,789 lb. of bullion from an equivalent of 520,272 tons of ore having a yield of 47.67 lb. per ton. This gives an average of about 368 tons of ore treated to bullion or 17,600 lb. of bullion per man per annum.

⁂

Daly West Mining Co.

A summary given in the 1912 annual report of the Daly West Mining Co., Park City, Utah, shows that since the date of organization, November, 1893, to the end of 1912 the company has received $15,058,185 for its product, out of which it has paid $6,579,000, or about 44% in dividends. The 1912 costs, as indicated by the statement of disbursements, shows that 55,850 tons of ore were mined at a cost of $6.05 per ton, including exploration and development. The development and exploration included amount to 7131 ft., at an average cost of about $17.60 per ft. General expenses, not included in above, were 54.7c. per ton mined. Of the 44,260 tons of ore sent to the mill 1369 tons or 3.1% was sorted out at a cost of $1168, which gives a cost of 85c. per ton of rock discarded or 2.66c. per ton of rock handled by sorters. Based upon the tons of sorted ore milled the cost of milling was $1.45 per ton, including assaying charges, but not sorting. The ore milled contained 5.5% lead, 8 oz. silver, 5.2% zinc, 3.9% iron, and 70.4% silica. The actual saving effected by the mill was 98.7% of the lead and 81.1% of the silver. Zinc concentrates made amounted to 1465 tons, assaying 20.62 oz. silver, 6.22% lead and 34.29% zinc. The lead concentrates ran 34.45 oz. silver, 0.0358 oz. gold, 30.84% lead and 1.1% copper.

⁂

Milling and Cyaniding Costs at Bodie, Calif.

Detailed milling and cyaniding costs at the Standard Consolidated Mining Co., at Bodie, Calif, are given in the yearly report. The mill treated 8150 tons of ore, having an average value of $11.72 per ton. The total cost of treatment was $1.922 per ton, the division being, labor, $0.926; supplies, $0.381; express on bullion, $0.042; bullion treatment, $0.020; and distributed accounts, $0.553. Supplies included per ton cost of $0.039 for 25 battery shoes; $0.057 for 63 dies; $0.004 for two boss heads; $0.011 for liners; $0.012 for screens; $0.034 for 6 mill plates; $0.011 for 1777 oz. quicksilver; $0.009 for heating; $0.070 for 71½ cords firewood and $0.134 for sundries.

The distributed accounts were: Bullion room, $0.033 per ton; stable, $0.039; yard, $0.100; power plant, $0.265; assay office, $0.041; blacksmith shop, $0.033; and machine shop, $0.042. The mine did not produce ore enough to keep the mill running at full capacity but an actual extraction of 46.3% was obtained on the material which was milled.

The cyanide plant treated the tailing from the mill and also 16,568.68 tons of slime tailing from old ponds.

The mill tailing reached the cyanide plant with an average value of $5.80 per ton, and the tailing from the slime ponds averaged $5.63 per ton. The average value of the combination treated was $5.69 per ton. The extraction by cyanide was somewhat more than 50% of the original value of the ore. Due to the combination of mill tailing and slime tailing handled, there seems to have been some difficulty in averaging the total actual recovery, which is stated to have been 103.5%. The error is probably due to the difficulty of proper sampling.

Consumption of material was: cyanide, 1 lb. per ton treated; lime, 14.6 lb. per ton; lead acetate, 0.1 lb. per ton; zinc, 0.5 lb. per ton; and pebbles, 1 lb. per ton.

Costs for the cyanide plant included labor, $0.854 per ton; cyanide, $0.269; lime, $0.192; zinc, $0.058; pebbles, $0.020; lead acetate, $0.013; heating, $0.007; cord wood, $0.031; sundries, $0.190; express on bullion, $0.052; bullion treatment, $0.019; and the distributed accounts amounting to $0.395 per ton. The total cost is $2.10 per ton treated. The total recovery in mill and cyanide plant was valued at $188,902.34. The proportion of gold and silver in the material sent to the cyanide plant averaged $5.03 gold, and $0.66 silver per ton over the yearly period.

The Nipissing Cyanide Mill

According to the eighth annual report of the Nipissing Mines Co., the new low-grade cyanide mill completed in 1912, treats an average of over 200 tons of ore per day. This mill has 40 stamps of 1500 lb. each and four 6x20-ft. tube mills. Six Dorr classifiers are in a closed circuit with the tube mills and all the ore is slimed before cyaniding. The silver is precipitated out of the cyanide solution by aluminum dust, the precipitate carrying 93% silver. This is refined to bullion 999 fine in one operation. The ore going to this mill is previously crushed to 1½-in. size and hand sorted on a traveling belt. The cost of the mill was $254,840. The crushing and picking plants, two tramways, roads and shops cost $69,811. Assuming the annual capacity of this plant to be 60,000 tons, the cost of construction came to about $4.25 per ton of annual capacity for the mill proper, and about $5.25 for the whole plant.

Tonopah-Belmont Costs

The annual report of the Tonopah-Belmont Development Co., Tonopah, Nev., to Feb. 28, 1913, states that 129,537 dry tons of ore were treated during the year at a cost of $8.96 per ton plus a total loss in treatment of $1.64 per ton of ore. Net recovery from all ore amounted to $22.70 per ton, leaving a net profit from operations of $13.74 per ton. This cost consisted of mining, $4.12; transporting ore, 28c.; milling, $2.96; marketing products, 49c.; and general expenses, including administration, $1.11 per ton. The new mill was operated from August, 1912, and treated 84,886 tons for a direct cost of $2.91 per ton during the seven-month period. The February, 1913, cost was $2.783, made up as follows: 11.2c. for crushing and conveying; 35c. for stamping; 43.9c. for tube milling; 8.4c. for concentrating; 6.3c. for classifying; 3.2c. for thickening; $1.149 for agitating; 17.7c. for filtering and discharging slimes; 18.8c. for precipitation; 1.6c. for assaying; 8.3c. for refining; and 9c. for shift bosses, watchmen and surface. The indirect milling cost for the same month was 54.5c. and consisted of administration, 7.1c.; office and storehouse, 2.8c.; taxes and insurance, 9.3c.; depreciation, 34.8c.; and general expenses, 0.5c. per ton. The total milling cost, including indirect charges amounted to $3.328 against an average of $3.444 for the whole period of operation. From November to February, inclusive, labor at this mill ranged from 54.4c. in February to 57.6c. in December per ton of ore; miscellaneous expenses, including superintendence, from $2.123 in January to $2.22 in December; and power from 54.2c. in November to 62.6c. in January. The average power cost for the seven months was 58.6c. per ton. The average stamp duty was 7.5 tons per stamp.

Some of the principal items of mining cost were: Miners in stopes, 57.2c. per ton; shovelers in stopes, 36.2c.; trammers in stopes, 20.9c.; timbermen and helpers, 67.9c.; explosives, 32.9c.; hoisting ore to surface, 28.1c.; superintendence and shift bosses, 12.4c.; mine office, 12c.; surface and plant, 12.8c.; and pumping, 14.7c. per ton of ore.

Costs at a French Gold Mine

The *Mining Journal* gives these particulars, for 1911, of a French company working an auriferous quartz and mispickel deposit: Ore broken, 96,870 tons, averaging 7.716 dwt. of gold per ton; crushed ore amalgamated and cyanided, 97,245 tons; fine gold obtained, 35,884 oz.; fine silver recovered, 4823 oz.; refined arsenic, 155 tons; the extraction equalled 92.1% of the contained gold; the total cost of mining and reduction was £74,452. The cost per ton was 15s. 4d., to which must be added 1s. for administrative expenses, making a total of 16s. 4d.; of this latter sum 10s. 4d. represents mining and raising the ores, and 6s. the reduction to fine gold. The final tailings still retain two-thirds of a pennyweight. From these figures it is manifest that quartzose auriferous ores inclosing 4 dwt. per ton may be considered payable. In the present case the profit made was about 16s. per ton of ore treated. Comparing these figures with those of the Witwatersrand, where in 1912 the aggregate extraction amounted to 29,163,803 tons, of which 27,389,872 were crushed for a total cost of 18s. 8d. per ton, as compared with 18s. during 1911, our contemporary observes: The cost per ton in France was 2s. 4d. per ton lower than in the South African gold field, and is the lowest yet known for the reduction of combined gold.

Calumet & Arizona

The annual report of the Calumet & Arizona Co. and the Superior & Pittsburg Copper Co. for the year ended Dec. 31, 1912 states that 53,108,628 lb. of refined copper were produced by the two companies. The total cost of this copper, as indicated by the expenditures, was 7.10c. per lb., made up as follows: Expenses at mines and smeltery, 7.01c.; salaries and general expenses, 0.13c.; freights, refining; and marketing, 1.42c. and other expenses, 0.08c.; total, 8.64c. per lb. A credit of 1.64c. per lb. of copper for precious metals leaves a net cost as stated. Attention is called to the fact that a 500-kw. turbo-generator was run continuously for 640 days.

Hydraulicking at La Grange Mine

SYNOPSIS—Notes on the essential points in the laying out of hydraulic-mining operations and on the practice at La Grange mine in Trinity County, California.

Hydraulic mining may be considered as having begun with the gold pan and to have progressed through the rocker, the sluice and ground sluicing to the use of hydraulic giants. The practice has grown from small nozzles of one or two inches, operating under a head of 75 ft., to 9-in. nozzles operating under a 625-ft. head.

In examining a gravel deposit as to its availability for hydraulicking, the gold content must first be determined by shafts or drill holes or both, or by small-scale operations. The physical condition of the gravel, that is, whether it is loose or cemented, high or shallow, narrow or wide, must be ascertained. The amount of available water and the cost of its utilization must be determined from surveys. The dumping space, particularly as affecting the length of sluice, must be considered and also the character of the bedrock, since if the latter is soft, it collects gold in its natural riffles and much of it must be cleaned up at the end of the season.

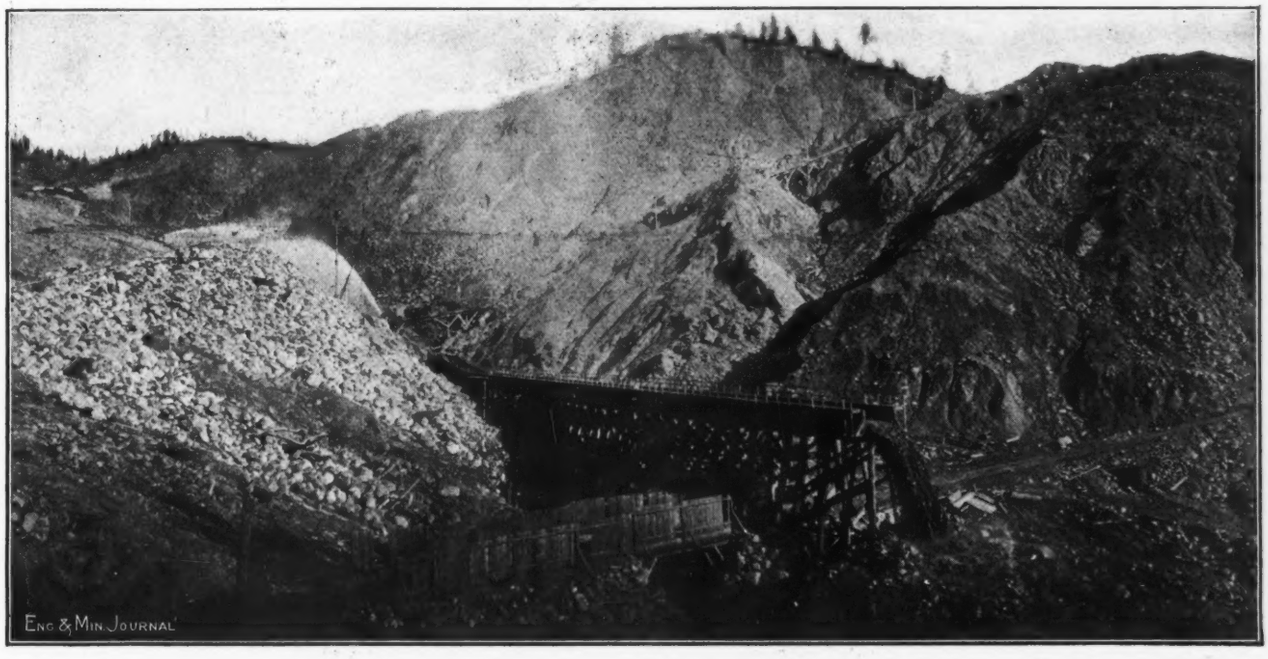


FIG. 1. TAILINGS DISCHARGE OF LA GRANGE SLUICE

SLUICE MUST BE KEPT AT LOWEST POINT OF BEDROCK

In opening a hydraulic mine it is important to determine the slope of the bedrock, in order to place the sluice so that it will always be below its lowest point. To mine profitably the characteristically low-grade deposits running from a few cents to 10 or 15c. per cu.yd., they must be opened so that the sluice will not have to be moved. La Grange mine has a channel about 1½ miles long, four miles from the present channel of the Trinity River and 700 ft. above it. The mine was opened on one side of the channel, and after working three or four years it was found that the bedrock dipped away. The sluices were started in the bedrock, but their grade carried the operation up into the gravel; hence it was not possible to get the material into the sluice without other than hydraulic means. The mine was then reopened at the lowest point in the deposit, on a fault line, one side being a greenstone and the other a slate which has slipped off the greenstone, leaving the latter smooth. In this manner the sluice was kept below any other place in the bedrock. Even the cleanup material can now be driven into the sluice by bringing giants in front of it and washing in the gravel.

METHODS OF CONDUCTING WATER

The water supply for La Grange mine involves a ditch 40 miles long, over rough country. This ditch carries about 3000 miner's inches; one inch is, by law in California, 1½ cu.ft. per min. Our calculations use as a unit the volume one miner's inch affords in 24 hr., or about 80 cu.yd. of water. In this ditch is one inverted siphon 6700 ft. long, crossing Stewart's Fork. It is a 30-in. pipe line of ½-in. steel, carrying a head of 1100 ft. in the center. The water then runs through a 4-mile flume and a 6000-ft. tunnel. The cost of this system was warranted only by the great size of the gravel deposit. The gravel bank is over 1½ miles long, ½ mile wide and 650 ft. high at the center, and contains 650,000,000 cu.yd. in place.

Hydraulic mine water-systems usually include, near the mine, a reservoir capable of holding the capacity of the ditch for four or five hours. This system permits the use of an equipment in the mine consuming a much greater volume of water than the actual flow of the ditch, and by collecting water in the reservoir, affords

Note—An abstract of an article by H. L. Mead in the "School of Mines Quarterly," April, 1913, entitled "Principles of Hydraulic Mining."

opportunity to repair the sluice, reset the giants, repair the pipe line, or blast and remove heavy boulders.

In locating a reservoir, the effect of a possible sliding of the bank when part of the gravel has been washed away, should be considered. This has been known to cause the reservoir to break and flood the mine. If possible, the reservoir should be in the solid country rock far enough away from the channel so that it will not be disturbed after the gravel is removed. At La Grange mine, this condition requires the main reservoir to be a long distance from the face, and as it is much cheaper to convey water in ditches than in pipe lines, three reservoirs have been placed on the deposit. Eventually a new reservoir will have to be built because a ditch cannot be maintained long over the gravel.

Pipe lines from the reservoirs are of the largest size that can be placed. At La Grange there are two pipe lines 30 in. in diameter, which bring the water to within 150 ft. of the giants at only a slight loss of head. Small mines often use smaller pipe with great loss of head. Gates are placed at the reservoir and, for emergencies only, where the pipe tapers to 18 in. at the giant. They are necessary, since in a pipe line ¾ mile long, it takes several minutes for the water to cease flowing. Gates are always closed with considerable care on account of the inertia of water which might otherwise break the pipe.

Placing of the Giants

The giants are placed at the ends of the pipe line; for a 6-in. nozzle no pipe smaller than 15 in. should be used with a nozzle unless plenty of effective head can be wasted. The placing of the giants is a matter of some difficulty and it requires a great deal of experience to set them solidly and to get them where they will be most effective. The effective pressure at the giant must be in proportion to the hardness of the bank and to its height. With a 650-ft. bank, the giants must be some distance from the face, because, as the toe of the bank is washed away, the boulders dropping down, jump two or three hundred feet across bedrock before coming to rest. At La Grange six or eight feet of rich gravel lie under 75 or 80 ft. of hard gravel cemented by iron oxide; this, when first exposed, is almost as durable as concrete, but it weathers easily and with the high head of water it is possible to place the giants back from the danger zone, and still break this cemented bank.

To do good work the giants must have such a head that their cutting effect will always be in excess of the carrying capacity of the sluice. That is, it should be possible to cut down and bring to the sluice more gravel than the same amount of water will transport through the sluice. That demands an extremely high effective head on the mains, which in many cases is not obtained. If

Fig. 2. Giants at Work, La Grange Mine

Fig. 3. Method of Directing Giant

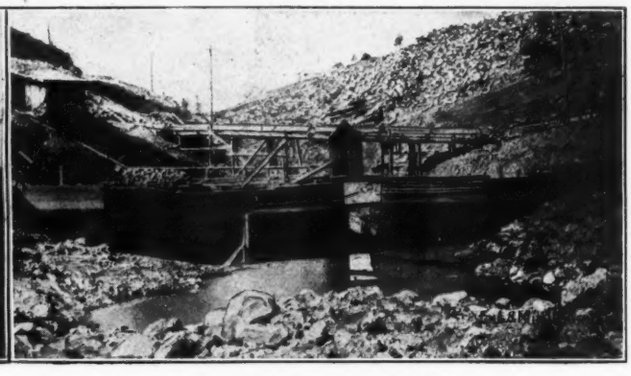
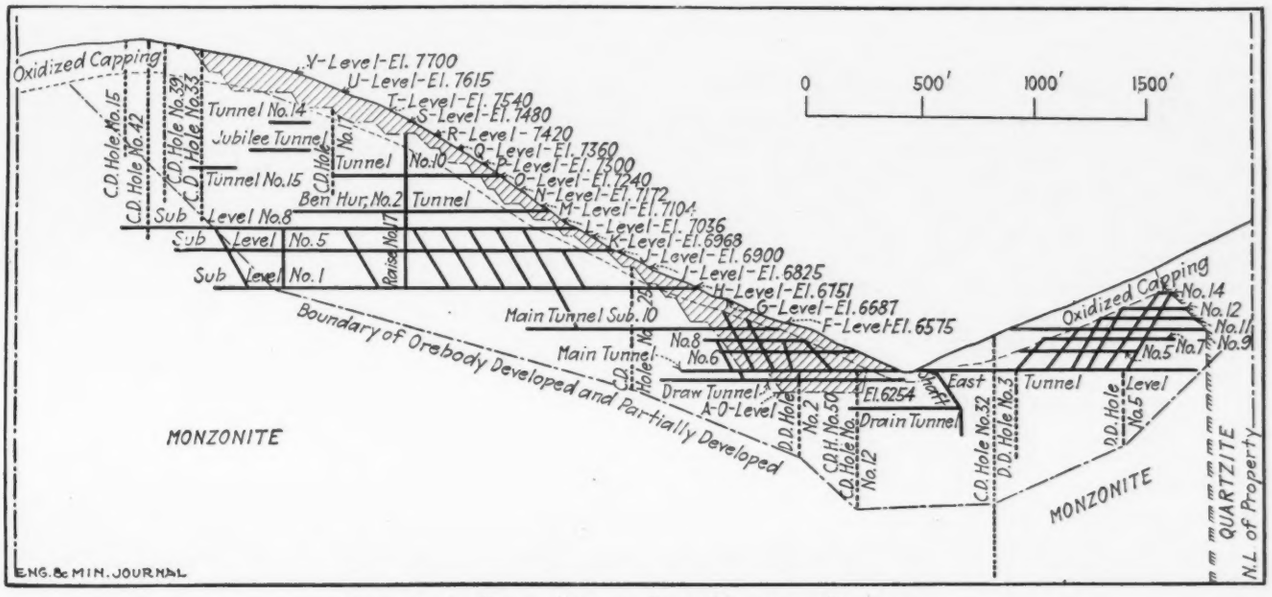


Fig. 4. Head of Sluice

an excess cutting effect is available, the giants can at any time be turned away from the sluice so as not to crowd it above its capacity.

Sluice Construction

A most important feature in the mine is the sluice and bulkhead. At La Grange there are boulders which weigh as much as 15 or 20 tons. The mouth of the sluice is six feet wide in the clear and 18 ft. in height. With the excessive force of our giants and the great amount of water, boulders which will just pass the head of the sluice can be sent clear through it. Boulders weighing eight or 10 tons have been handled. The bulkhead is reinforced against wear by 18-ft. lengths of 40-lb. steel rails. The giants are placed far enough back so that they command the entrance to the sluice. They generally work in pairs; they first cut down the bank and then by swinging around and following the material, make a "double header", adding water to that which has cut the gravel. By these big rushes the heavy material is carried into the sluice. Instead of wooden blocks for paving the sluice, there are now used manganese-steel rails. In designing a sluice, the perimeter that gives least friction and highest velocity should be used. The main point is to get the greatest capacity per unit quantity of water. This can be done only by building the sluice so as to get the right depth of water in the sluice at the right grade. The grade in most cases is dependent on local conditions; a sluice of average size would generally have a grade of eight inches and seldom less than six inches per 12-ft. box. At La Grange sluice six inches is used, but by permitting the gravel to accumulate in the sluice, and by building up the sides, an 8-in. grade can be made. While cutting down the material with the giants, all will not be carried to the head of the sluice; neither will the material have a high velocity in the direction of the sluice when it first enters. In order to start the material down the sluice, it is advisable to build a high bulkhead, affording a high head of water, so that it will rush through. Then by building up the sides of the sluice near its head, a high grade is obtained, and the material given a good start down the sluice. The head of the sluice thus controls the capacity of the entire operation, and in every economical way, it is attempted to make the capacity per unit quantity of water as great as possible.



Profile of Utah Copper Co.'s Bingham Property

Utah Copper Co.

The report of the Utah Copper Co. for the year ended Dec. 31, 1912, shows that the total area of lode mining claims owned by the company consists of 740.394 acres, and other lands, in which is included Bingham Cañon lands and the land containing the Magna and Arthur plants amount to 5281.85 acres.

The length of tunnels, drifts and raises driven during the year 1912, was 35,473 ft., bringing the total length of all underground work at the end of the period up to 414,691 ft., or 78.54 miles. Of this total, a large quantity has been destroyed by steam-shovel work and by underground work, but the workings still accessible amount to 29 miles. The cost of underground development for the year amounted to 15.62c. per ton on all ores mined from underground workings, and to 3.47c. per ton on the total tonnage of all ores mined and shipped to the plant both from the underground workings and steam-shovel levels. Churn drilling cost 1.04c. per ton on all ore produced. The total cost of both underground and surface development amounted to 4.51c. per ton of ore mined. This cost was all charged against operations and is included in the per ton mining cost for the year.

Previous to Jan. 1, 1913, there had been developed 257,584,500 tons of ore classed as fully developed, and 80,116,324 tons as partially so. This tonnage includes about 28,800,000 tons of partially developed ore in the slopes of the steam-shovel workings. The average assay of the fully developed ore is slightly in excess of 1.60% copper, and the average of the partially developed ore is 1.16% copper, making the average assay of a total of both classes 1.50% copper. There was mined prior to Jan. 1, 1913, a total of 21,200,842 dry tons of ore, averaging 1.542% copper, and the total reserves remaining amount to 316,500,000 tons averaging 1.495% copper. The year's

addition to reserves was 15,000,000 tons in excess of the tonnage mined.

The total amount of capping removed during the year was 4,676,568 cu.yd., the average rate being 389,714 cu.yd. per month. The average thickness over the entire orebody corresponds to 177,467 cu.yd. of stripping per acre. The total amount of stripping removed from the property represents the equivalent of completely stripping 97.43 acres. The ratio of stripping to ore, both as to thickness and tonnage, within the limits of the fully and partially developed area is approximately 1 to 4. The ratio of stripping to ore in the slopes themselves will be considerably greater than 1 to 4, and therefore, taking the slopes into consideration, the actual ratio of stripping to ore, for the whole orebody, will be somewhat higher than that stated, but in no event in excess of 1 to 3.

Underground mining operations were conducted at the Boston mine and the original Utah mine on the East Tunnel side of Bingham Cañon until interrupted by labor disturbances in September. These operations were resumed, in a small way, at the Boston mine in November, but it is not the intention to again do any underground mining in the original Utah area and it is purposed to discontinue underground mining altogether before the end of 1913. Of the total ore mined during 1912, 77.81% was obtained by steam shovels from the original Utah mine; 4.33% was mined underground in the Utah mine, and 17.86% was mined underground in the Boston mine. The average cost of steam-shovel mining for the year was 35.19c. per ton, of which 8.84c. represents charges on account of stripping expense and prospecting, leaving an actual working cost, including all extraordinary and general charges, except development and stripping expense, of 26.35c. per ton. The average cost of underground mining at the Utah mine during the year was 74.93c. per ton, of which amount 19.09c. was the cost of underground development; while at the Boston mine, the average underground mining cost for the year was 65.56c. per ton, which includes 14.39c., covering underground development. The average cost of underground mining for the year at both mines was 67.39c. per ton, of which amount 15.62c. represents the cost of underground development.

During 1912 no additions were made to the equipment at the mines. No extensive additions were made at the Magna plant, excepting the enlargement and improvement of the coarse-crushing department, which work was commenced during the year with a view to increasing the capacity of that department for handling wet and frozen ore in winter weather. The Arthur plant has been entirely remodeled, the thirteenth and last section being finished early in September.

During the year there were milled at the Magna plant 3,454,800 tons of ore, while at the Arthur plant, the full capacity of which was not required, 1,860,521 tons were milled. During the summer months, the Magna plant demonstrated its ability to handle over 12,000 tons of ore daily and the reconstructed Arthur plant has shown a capacity of over 8000 tons per day. With the coarse-crushing departments of both plants enlarged and improved so that they can handle full tonnage when the ore is wet or frozen, the combined economical capacity of both plants is therefore about 21,000 tons per day.

The average grade of ore treated at both plants was 1.3642% copper. The average recovery for the year at the Magna plant was 66.03%, and at the Arthur plant, 66.86%. The average recovery at both plants was 66.32%, corresponding to 18.09 lb. of copper per ton. The cost of milling at Magna was 39.64c. and at Arthur, 45.18c. per ton. The average cost of milling at both plants was 41.58c. per ton; the average cost of both plants during the first nine months of the year was only 35.46c. per ton, as compared with 70.39c. per ton at the last quarter, this difference being accounted for by the unsettled condition generally, particularly as regards labor, during that period. The milling cost is expected to be less than 30c. per ton when conditions are such that the mills can be operated at full capacity of about 21,000 tons per day. The total gross production of copper contained in concentrate, for the year, was 96,175,090 lb. The concentrate produced averaged 20.75% copper. The average cost per pound of copper produced for the year, after making allowances for smelter deductions and applying credits for gold and silver recovered, but without crediting miscellaneous income, was 9.024c., as compared with 7.8655c. for 1911.

If the miscellaneous income in Utah, including that from the Bingham & Garfield Ry., amounting to 0.243c. per lb., were credited to the cost of production, the net cost per pound of copper for the year would be 8.781c. If, however, the total net earnings of the Bingham & Garfield Ry., in addition to other miscellaneous income in Utah, were used in this way, the amount would be 0.565c. per lb., and the cost per pound of copper for the year, reduced by this amount, would have been 8.459c. total cost. The net value of gold and silver recovered amounted to 0.957c. per lb., as compared to 1.07c. in 1911. For the months of July and August, those being the first ones in the history of the company in which full capacity was approximated, having averaged 19,616 tons per day of ore containing 1.4196% copper, there was produced not quite 22,000,000 lb. of copper, net, at a cost per pound, without the application of any credit from miscellaneous or railroad earnings, of 7.61c. If actual railroad earnings for those two months, together with other miscellaneous income in Utah, had been applied to reducing the expense of making copper, the cost would have been 6.89c. per lb.

The average total cost of mining and milling for the year, exclusive of transportation charges, was 83.91c. per ton. There is included in this cost a charge of 4.51c. per ton, to cover the cost of churn-drill and underground development, as well as a fixed charge of 7.5c. per ton for the retirement of stripping expense. The average cost for the year of mining, transportation and milling was, for mining, $0.4233; transportation, $0.2848 and for milling, $0.4158; total, $1.1239 per ton milled. Further reductions in expense are expected, among which will be the lower cost of power, accomplished by the use of hydro-electric power from the Utah Power & Light Co., under a 25-year contract.

The Bingham & Garfield Ry., which is owned by the Utah Copper Co., constructed additional trackage during the year of 21.196 miles. Of this total, 3.664 miles may be classed as main line, as it represents an extension constructed to the shores of the Great Salt Lake for the purpose of transporting fluxing material to the Garfield smeltery. The total amount of track now existing amounts to 97.602 miles. During the year the road handled 3,620,750 tons of commercial freight. Of this quantity, 3,381,161 tons were ore shipped by the Utah Copper Co.,

the daily average for the year being 9238 tons. For the months of July and August, which were the only ones during the year in which the Utah Copper Co. operated at approximately full capacity, the average daily amount of ore handled by the Bingham & Garfield Ry., was 13,253 tons.

The operating profit of Utah Copper Co. for the year amounted to $6,307,242. The miscellaneous income from outside investments, which included the dividends received from the stock owned in the Nevada Consolidated Copper Co., amounted to $2,222,562. The total income was $8,529,804. Interest during the year amounted to $80,532 which, being deducted, leaves a net profit for the year applicable to dividends and for other capital purposes, $8,449,272. Dividends paid during the year amounted to $4,729,747.

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Tonopah-Belmont Development Co.

The report of the Tonopah-Belmont Development Co. for the year ended Feb. 28, 1913, shows the net earning of the mine and both mills during the fiscal year to be $1,773,227 as compared with $1,802,081 for the previous year. The operating expenses of the mine for the fiscal year, compared with previous three years are as follows: For the year ended in 1910, 36,930 tons of ore milled at a cost of $287,486; for 1911, 81,066 tons of ore milled at a cost of $498,164; 1912, 115,563 tons of ore milled at a cost of $560,446; 1913, 129,537 tons of ore milled at a cost of $564,722. The cost per ton varies from $7.78 in 1910 to $4.35 in 1913. At the Tonopah mill 84,886 tons of ore were milled at a total cost including direct and indirect expenses, $3.44 per ton. At the Millers plant 60,359 tons of ore were treated at a total indirect and direct cost of $4.16 per ton.

The ore reserve in the property consists of 229,185 tons of positive ore and 126,020 tons of probable ore, together with 155,218 tons of possible ore, a total of 510,423 tons. A greater tonnage of all classes of ore would be arrived at by estimating greater widths of vein matter between the walls, which would seem plausible, but the included waste in the veins, which is very variable, might prove to be in such great proportions as seriously to vitiate such a result. The mining and development work aggregated 12,513.5 ft. segregated as follows: Drifts on Belmont vein, 2841 ft.; raises and winzes on Belmont vein, 1850 ft.; crosscuts in and from Belmont vein, 4678 ft.; drifts on other veins, 1836 ft.; raises and winzes on other veins, 497 ft.; exploration crosscuts in other parts of the mine, 809 feet.

Stoping on the Belmont vein during the year extended over 92,134 sq.ft. of vein area, the crude ore from these stopes totaling 137,814 tons. Stoping on the Shaft vein, over 13,045 sq.ft. produced 7921 tons of crude ore; on the Mizpah Fault vein, over 11,961 sq.ft produced 4896 tons of crude ore; on the Lillie Belle vein, over 2893 sq.ft. produced 1151 tons of crude ore. After a forced stoppage of the work of sinking the Belmont shaft during a period of retimbering, sinking was again resumed in November from the 1465-ft. point. Immediately after this sinking a larger flow of water than ever previously met was encountered, which so seriously hampered the work, the sinking pumps not being of sufficient capacity and the station pump being taxed to its limit by the flow that at times exceeded 200 gal. per min., that during November, December and part of January, but little progress could be made and but 18 ft. of shaft was completed. During January the amount of water decreased greatly and since that time an average of only about 70 gal. per min., the normal flow, has been handled and the shaft sinking has made excellent progress, 67½ ft. having been sunk in February.

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New York Section of A. I. M. E.

The annual meeting of the New York section of the American Institute of Mining Engineers was held in New York on May 2, 1913, George F. Kunz, chairman of the executive committee, presiding. The following officers for the ensuing year were unanimously elected: Chairman, Louis D. Huntoon; vice-chairman, Arthur S. Dwight; secretary, Thomas T. Read; treasurer, Ellsworth M. Shipp.

Prof. Dr. M. Belowsky, custodian of the Mineralogical and Petrographical Institute and Museum of the University of Berlin, was introduced as the guest of the evening. The worthy *Doktor* replied in his native tongue, winning applause by his evident earnestness and enthusiasm. Doctor Belowsky is in this country to collect specimens of representative minerals. His search is not so much for perfect crystals as for specimens which will illustrate the association of minerals and gangue. The members were asked to give the visitor all possible assistance in carrying out his mission.

Metal-Mining Accidents

Albert H. Fay, mining engineer of the Bureau of Mines, discussed the noteworthy points in the statistics he had collected on metal-mine accidents in the United States in 1911, published as Technical Paper 40 by the Bureau. An abstract of this compilation was given in the Journal of Mar. 29, 1913. The deaths due to accidents in metal and nonmetal mines, excepting coal, were 695, which makes the rate 4.19 per 1000 men employed, as compared with 3.73 per 1000 for the coal mines. Since the average number of days worked in the former group was 282 as compared with 220 in the latter, the rates are not truly comparable. Mr. Fay, therefore, took 300 days as representing the average number of working days in a year at metal mines, and calculated the death rates for all groups on this basis. The results are shown in the accompanying table. It will be noted that this makes the rate for all mines, except coal, 4.45, while the coal-mine rate is raised to 5.09.

ACTUAL FATAL-ACCIDENT RATE IN MINES COMPARED WITH RATE BASED ON 300 WORKING DAYS

Mines	Actual days worked	Actual number of deaths per 1000 employees	Deaths per 1000 calculated on 300-day basis
Copper	308	5.33	5.19
Iron	277	4.29	4.65
Lead and zinc (Mississippi Valley)	256	3.43	4.02
Gold and miscellaneous	276	3.95	4.30
Nonmetal (except coal)	258	1.73	2.01
All mines (except coal)	282	4.19	4.45
Coal mines	220	3.73	5.09
Quarries	228	1.69	2.22

The Catskill Aqueduct

John R. Healy, assistant engineer of the Bureau of Water of New York City, was called upon to give some of the sources of accidents and the preventive measures used in connection with tunnel work on the Catskill

Aqueduct. The handling of explosives was one fruitful source of accident. In order that each day's supply of explosives could be safely stored underground, a special magazine was provided, which was separated from the tunnel heading by a heavy door, the explosives and caps being stored within the magazine at safe distances apart in offsets from the general course of the tunnel. The explosives are under the direct control of a licensed magazine keeper.

In driving the tunnel, 22 to 25 holes are drilled and shot in three rounds. A regulation provides that one round shall be loaded and fired before the next is loaded. Electric firing is required. The men who do the loading and firing must also have shown their competency for the work. The firing circuit is carried on the opposite side of the tunnel from the lighting circuit. The circuit connections are accessible only to the heading boss, and the circuit is broken after each firing.

To reduce the accidents from falling rock, careful scaling is done by special men. In particularly bad ground timbering is resorted to. Since no timber is left after grouting is placed, the removal of these supports sometimes resulted in accidents. For this reason permanent steel supports are being used.

In hoisting operations, the usual overwinding devices and safety dogs on cages are provided. Despite the law against it, men used to ride loaded buckets especially when steel was sent down. Means are now provided for readily fastening the steel to the hoisting rope. Electric motors are used for transportation underground. Where the grade reaches 9% derailing switches are provided as well as ample manways along the side of the track. The concrete is put in under high pressure; breaking of couplings causes the hose to thrash around and has resulted in some accidents. In the concreting of shafts, the men have to work on narrow planks. These are made as safe as possible, but the men resented the placing of lifenets below them and the provision of lifelines.

McKesson-Rice Screenless Sizer

Thomas B. Stearns, of the Stearns-Roger Manufacturing Co., explained briefly the principles of operation of the McKesson-Rice screenless sizer. This device is used to separate different sizes or grades without the use of screens or other means by which aperture determines the size.

The machine combines several basic principles in the accomplishment of this result. First, the phenomenon by which particles rolling down an inclined plane tend to arrange themselves with the largest particles at the bottom and the smallest higher up on the slope, is made use of. Second, if the inclined plane is subjected to a horizontal force causing it to move back and forth in its plane, particles started from an upper corner will be spread out over the surface of the slope in a fan-shaped arrangement. Third, the angle of slope and the horizontal force may be so adjusted that a given particle upon which these forces act, will remain stationary at a certain point.

The sizer is composed of a steeply inclined deck mounted on a frame supported by toggles, the desired back-and-forth movement being imparted by the Wilfley-table head motion. The deck itself is made up of a series of baffles or steps. On these baffles is a corrugated covering, the corrugations running at right angles to the direction of slope. The deepest corrugations are on the first baffle and the shallowest on the last, with gradations between. The material to be sized is fed at the top of the first baffle, those particles the centers of gravity of which are above the top of the riffles tending to roll down the baffle. By reason of the shake imparted to the deck, only the coarsest particles will reach the bottom and be discharged, while the rest of the material will be projected to the next baffle where the operation is repeated, the next finer particles reporting at the bottom. The number of baffles used depends on the number of sizes to be made.

At present the machine is limited to sizing dry material. Experiments in sizing garnet for abrasives yielded good results, 16 different sizes being obtained. For abrasives corrugated rubber is used to cover the decks; for stone and coal, pressed steel; for grain, salt, etc., wood is used.

On this table, an absolutely volumetric result is obtained. The device takes no notice of specific gravity; shot and carborundum have been mixed and the particles of the same size have reported at the same point.

The advantages claimed for this sizer as compared to screens are: Much lower cost of upkeep; the avoidance of variable results as noted when screen apertures increase from wear; low power consumption; saving in floor space, and in the sizing of anthracite coal, there is less liability of breaking by abrasion.

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Goldfield Consolidated in March

The report of A. Burch, general manager of the Goldfield Consolidated Mines Co., states that the total production for March, 1913, was 30,005 tons, containing $725,622, or an average of $24.18 per ton, of which 27,542 tons were milled with an average extraction of 92.41%, and 2463 tons were shipped of an average value of $26.82 per ton; the net recovery from all ore was $22.51 per ton. The net profit was $470,113, or $15.66 per ton.

Development work amounted to 3417 ft. The total operating costs were $7.02 per ton, distributed as follows: Mining, including stoping and development, $3.24; transportation, 8c.; milling, $2.08; marketing, 8c.; general expense, 35c.; bullion tax, 25c.; marketing ore, $1. From this, 6c. was deducted for miscellaneous earnings. The diamond-drill hole from the bottom, or 380-ft. level, of the Combination passed through the Reilly vein at a vertical depth of 50 ft. and cut seven feet of $25 ore. A winze station was commenced for the purpose of developing this ore and produced 63 tons, averaging $43.40 per ton.

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Malay States Tin Output

The tin output of the Federated Malay States is given in the accompanying table, taken from *In Tinland*, Jan. 20, 1913. For converting into other weights, 1 pikul = 133.3 lb.:

State	1911 Pikuls	1912 Pikuls
Perak	437,339	476,319
Selangor	231,175	255,382
N. Sembilan	29,230	29,046
Pahang	43,954	51,779
Total	741,698	812,526

CORRESPONDENCE AND DISCUSSION

Dowsing in France and in Colorado

The article "Dowsing in France and in Colorado," in the JOURNAL of Apr. 26, 1913, recalls to mind a long string of metal and water dowsers, so many, in fact, that I could write a book on the subject. However, I will only mention a gold and a water dowser who operated in Nevada.

Almost every mining camp, particularly during a rush, receives a dowser, and if a sucker or two is found, more dowsers loom up quickly. (I might add that at least three shafts were sunk in the Goldfield district by direction of a gold dowser. One was abandoned, having found nothing of value, another struck such a flow of water on the 200 that it caused a permanent shutdown, while the other found some ore, and after spending a lot of money, is considered a prospect). But the story I started to relate is one where a dowser came in with the first boom.

He made his business known to the boys, and three miners who owned claims made an appointment with him at their shack. When he arrived and explained his gold-finding apparatus, which could be worked only by him, one of the miners who had said nothing up to this point, pulled out a $20 goldpiece, showed it to Mr. Dowser, and said, "Partner, I'll plant this outside the shack somewhere in the ground, and if you can find it with that layout, it's yours; besides we will give you a chance to locate ore for us." Then telling the miners to see that the dowser's back be kept to the door and that no one was to leave the shack until his return, he left and walked to the sunbaked garden patch nearby; stooping over, he dug a hole with his hands, then piled up the dirt again, this he repeated half a dozen times at different points in the garden, then started for the shack, but in nearing the end of the rows he leaned over, and at arm's length dropped the goldpiece in a crevice opened by the hot sun and returned to the shack; entering he said: "Partner, the show's ready." The dowser fixed his outfit and started on the trail to the garden. He stopped at the first hole the miner dug, finding nothing; he found the other holes with a like result, then he said the miner had not planted the coin, but the miner pointed over to the spot and had one of the boys remove the twenty and hand it over. Needless to say, Mr. Dowser left for unknown parts the following day.

At another camp, about 30 miles from Death Valley, a water dowser showed up one day, having heard that the water holes were nearly dry, and agreed to find all the water the camp could use. A dicker was finally made with him; he was to locate a spot in a large gulch near the camp and the foreman was to sink a hole, and in the event of finding water he was to be paid, otherwise he received nothing. He maneuvered over the gulch for some time and pointed out a spot at the edge of the wash, about 100 ft. from the shacks, and said: "You will get water here at 30 ft." The hole was sunk through the wash, and bedrock found at about 30 ft., but the foreman put her down to 60 ft., the last 30 in rhyolite. The hole, of course, was dry as sage brush, but the foreman ran a flume from the overflow of a water hole cut in the rhyolite in a short ravine emptying into the gulch, and after the first big rain and water-spout that this section is subject to, filled his 60-ft. hole to bedrock and had a good cool well. But they don't all end thus happily. I have seen dowsers work from New York to 'Frisco and from Canada down, but have never seen any water located that any intelligent man could not have located without their assistance.

CHARLES E. DUTTON.

Goldfield, Nev., May 3, 1913.

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What the Forest Service Offers the Prospector

So much has been said and written about the relation of the Forest Service of the United States Department of Agriculture to the mining industry, and so many misconceptions have been formed, that a few facts on the subject should be of interest to those actually engaged in mining.

In the first place, let it be understood that the fact that land is included in a national forest is no bar to mining or prospecting thereon. Paragraph 114 of the regulations under the U. S. mining laws, published by the General Land Office, states:

> **The act of June 4, 1897, provides that "any mineral lands in any forest reservation which have been or which may be shown to be such, and subject to entry under the existing mining laws of the United States and the rules and regulations applying thereto, shall continue to be subject to such location and entry" notwithstanding the reservation.**

In this connection it is of interest to note that an investigation by the Forest Service showed that during 1912 there were 2560 prospectors within the national forests of Colorado, as compared with 1475 on unreserved public lands immediately adjacent.

The relation of the Forest Service toward the possession of or acquisition of title to mining claims is confined to requiring that compliance shall be had with the mining laws of the United States, and is never asserted unless and until application is made to patent, except where improper use is made of a claim which actively interferes with the administration of the forest. The Forest Service has no authority to supplement the Federal laws with regulations of its own making, as can be done by states or mining districts, such as to require that a discovery shaft be sunk on the claim or that the discovery of mineral shall be made in the discovery shaft, as provided by the Colorado statutes, nor can it issue or refuse patent, this being exclusively a function of the Secretary of the Interior. When the owner of a mining claim desires a patent, the procedure is as follows:

The Surveyor General notifies the Forest Service when order for mineral survey is issued, and if possible the ranger accompanies the surveyor and makes his examination coincident with the survey, in order to obviate pos-

sibility of delay and make sure of the situation of claim lines and extent of improvements. If unable to be present when the survey is made, he makes his examination as soon as possible after application to patent is filed, and, except in occasional instances, this report is submitted to the General Land Office before the expiration of the 60-day period of publication, so that the examination by the Forest Service does not delay the issuance of a patent, except in case the required expenditure has not been made upon the development work.

Sec. 2320 of the revised statutes states that "no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claim located." But the ranger does not inquire into whether a discovery has been made. If the claim is in a recognized mineral locality, if the requisite expenditure of $500 has been made, and if the indications are that it is being held in good faith and not as a subterfuge to acquire ground for other than mining purposes, he will make a favorable report. In most cases, compliance with the second condition carries the third with it, and in this connection it might be well to quote from the National Forest Manual:

> It is not the purpose or the intent of the department to initiate contests against claimants who have entered lands in the national forests in good faith to secure a home or for other purposes recognized by law, and in such cases no contest should be initiated on slight, technical noncompliance with the law.

An opinion, quite general, seems to prevail that contests against supposedly invalid claims are initiated on the report of the ranger, who, it is true, sometimes has little or no knowledge of mining. This is incorrect. On receipt of a report from a ranger showing the non-compliance with the above conditions, the mineral examiner is detailed to the case. The mineral examiner is a man who must have had actual mining experience. He qualifies for his position by submitting to the Civil Service Commission a detailed account of his experience, with references to five previous employers and signed statements by two persons personally able to testify as to his fitness for the position, which application, if satisfactory, admits him to a competitive examination which consists chiefly of questions on geology and mineralogy.

The mineral examiner makes an exhaustive investigation of the claim, measuring and estimating the work and also considering the question of character and extent of discovery, and if it develops that no discovery has been made, as well as the claim being deficient in other respects, the facts are reported to the General Land Office. If the commissioner considers the facts sufficient to justify cancellation of the application for patent the claimant is informed of the charges against the claim, and given an opportunity to present his evidence at a hearing.

At the hearing both sides are represented by counsel and introduce witnesses as in a suit before a court of law. The evidence is submitted to the register and receiver of the Land Office of the district in which the claim is situated and they render a decision for or against issuance of patent, subject to approval by the commissioner of the General Land Office. Appeal may be taken to the Secretary of the Interior.

A prospector engaged in working his claim is entitled to such timber found thereon as may be necessary for its development, which includes timber for buildings, fuel, etc., as well as the actual support of excavations, and need make no application therefor. If there is no timber on the claim, he sends word to the ranger who calls on him and issues a free use permit for any amount necessary, up to $20 stumpage value. In case of an emergency, he can take such timber as he may need immediately, and notify the ranger at his first opportunity.

Probably a fair average of the prices computed for free uses in the second district, which includes Colorado, Wyoming, South Dakota, Minnesota and Michigan, would be $2 per M., board measure, for green sawtimber, $1.25 per M. for lagging, and 25c. per cord for firewood. If a prospector were living on his claim and working it the year around, 20 cords of firewood, $5, should be ample for his needs. This would leave him 15 dollars' worth of timber for his workings. A post 8 in. diameter and 8 ft. long is scaled as 10 bd.ft. Such a timber cut to say 6½ ft. in length has a safe working load (western yellow pine) of 46 tons for well seasoned timber, and half that amount for green timber. A post 10 in. diameter and 12 ft. long, sufficient for two caps, and some over, scales as 30 bd.ft., so that two drift sets would scale 70 bd.ft., 14c. worth of timber, a cost of 1¾c. per foot of tunnel, if the sets are placed on 4-ft. centers. To lag a 5x7-ft. drift on top and sides with 6-in. split lagging would require 19 ft. of lagging per foot of drift, or 2⅜c. per ft., so that the total cost at which the timber for a 5x7-ft. drift would be figured would be 4⅛c. per ft., so that the $15 mentioned after allowing for firewood, would furnish timber for 364 ft. of drift and leave plenty of scraps for blocking, fuel and other uses to which they could be put, all of which, under free-use permit, he obtains for nothing. Of course, a shaft would require more timber per foot, but less work is accomplished in the same time. Few prospectors require that amount of timber in a year, but a prospector may cut as much timber as he wishes from his claims without permit if the use to which it is put tends to develop the claim from which it is cut; and in cases of unusual need, the Forest Supervisor may extend the free-use permit to an amount not exceeding $100. Much more detail could be entered into along these lines, but I trust that the above facts may correct some of the prevailing misconceptions of the attitude of the Forest Service toward the mining industry, and show that it is the desire of the Service to promote and not retard the development of our mineral lands.

LEROY A. PALMER,
Mineral Examiner, U. S. Forest Service.

Denver, Colo., May 8, 1913.

Driving with Machines on Tripods

In criticizing the article, "Driving with Machines on Tripods," Robert Olds, of New York, must be reminded that the job in question was not considered as "high-speed tunneling" or as a remarkable achievement in any sense, but simply as a description of ordinary, everyday mine tunneling under disadvantageous conditions, which it was thought might prove interesting to practical mining men. Mr. Olds states that "any system which periodically covers the track with débris some distance back from the face cannot be tolerated." Tunnel contractors and mine superintendents would undoubtedly be much indebted if any system could be suggested by which this would be avoided.

THEODORE V. K. SWIFT.

Mineville, N. Y., May 7, 1913.

EDITORIALS

The Copper Statistics for April

A good report for April in the matter of reduction of stocks was expected, but the actual figures were better than looked for by anybody. The enormous exportation, following a very large exportation in March, will naturally excite suspicions of copper being shipped abroad on consignment, which no doubt is the case to a more or less extent, but nevertheless the European statistics for April showed a decrease, and it is undeniable, we think, that copper consumption, both in Europe and America is continuing at a very large rate.

On the other hand production is not increasing, to say the least. American refiners appear at last to be going about in step with the smelters and making an output of about 135,000,000 lb. per month, which is approximately the present supply of raw material coming to their furnaces. There have lately been troubles of one kind or another at some of the mines in Spain, Australia and elsewhere and it is possible that the extra American production of copper has fallen off to some extent, thus accounting in part for the steady reduction of stocks that has lately been going on. Anyway, it may confidently be recognized that the statistical position of copper is at present sound and strong.

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Equipping an Old Mexican Shaft

A 40-ft. circular shaft is an embarrassment of riches in these days. Modern high-speed hoisting has no use for so great an area of shaft section in any ordinary mine. The equipping of such a shaft, first for hoisting water and later for handling ore, was the problem that confronted the Guanajuato Reduction & Mines Co. Apparently the entire depth of shaft was untimbered. To set timbers over this section for the 1265 ft. would have been a financial, if not an engineering impossibility. The ingenious methods adopted for installing the necessary wire-rope guides, and of equipping the stations, is described in this issue of the JOURNAL by Douglas Muir.

The problems encountered were probably entirely new. Bailing itself is not an infrequent method of dewatering and is often efficient in handling the daily water flow. But in this case, it was necessary not only to lower the water, but to provide a set of guides and lower these also as the water was lowered. To have thought out in advance the details of this procedure and to have successfully applied the method chosen, is truly an achievement. Furthermore, while Guanajuato is a mining center and easily accessible for men and material, conditions in Mexico are always somewhat unfavorable, and any engineer who has had to work there, hampered by the lack of skilled mechanics and intelligent laborers, can appreciate the burden of responsibility that the managers of this enterprise carried.

It is in meeting unusual and untoward conditions that mining engineering shows at its best and the resourcefulness and judgment of the engineer is never more heavily taxed than in reëquipping an old property so as to make the most of existing advantages without sacrificing efficiency. Admiration is divided in the case of the Rayas shaft between the engineers who have adapted it to the modern conditions entirely different from that for which it was designed and the old Spaniards who had the courage and the persistance to complete so remarkable an excavation.

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The Amalgamated Report

The annual report of the Amalgamated Copper Co. has lost most of the interest that it used to have before the Anaconda company became the sole operating company in the Butte district, but it continues to throw interesting side-lights on affairs. The Amalgamated is now simply a holding company. In its last report no detailed inventory of its assets is presented, but we compute that at the end of 1912 it owned 3,063,905 shares of Anaconda, 100,000 of Greene-Cananea, 40,000 of International Smelting & Refining Co. and 150,000 of Inspiration. Besides, it had $1,000,000 of bonds of Butte, Anaconda & Pacific railway and $15,683,417 in cash and cash assets. Figuring Anaconda stock at $38, Greene-Cananea at $6¾, International at $112 and Inspiration at $19 $^{7}/_{10}$, the total of Amalgamated assets was $141,323,968. It owed $12,527,000 in notes (due Apr. 1, 1913 and subsequently renewed) and $7,737,112 in accounts payable. The total net value of the Amalgamated's assets, according to this figuring (which is our own, not the company's), is $121,059,857, or about $78⅔ for each of its 1,538,879 shares issued.

The predominance of the Anaconda asset is immediately evident. Roughly, each share of Amalgamated carries two shares of Anaconda, wherefore a decline of $1 on Anaconda shares means $2 on Amalgamated. In determining the value of Amalgamated consequently, the prime question is the value of Anaconda.

The Amalgamated may have some assets other than those that we have enumerated. Anyway, it has selling contracts with other companies which must bring in a good deal of revenue. In 1911 it took over the United Metals Selling Co. for $12,050,000, thus acquiring 40,000 shares of International Smelting & Refining Co. and cash and cash assets to the amount of about $11,000,000. To provide funds for this purchase, the Amalgamated issued $12,500,000 of two-year, 5% notes. In 1912, the company purchased $1,000,000 of the bonds of the Butte, Anaconda & Pacific bonds and 150,000 shares of Inspiration, paying $3,957,162 in cash therefor. Assuming the bonds to have been taken at par, the Inspiration stock cost about $19.70 per share. However, we imagine that there was some discount on the bonds and that the Inspiration was taken at $20, the subscription price.

The Amalgamated's mining and metallurgical investments are of a high class and represent value that is

approximately measured by the quotations for its stock. The company was once regarded as overcapitalized, but apparently it has now grown up to the hopes of its promoters.

Comparative Safety of Electric and Fuse Blasting

It is usually urged in favor of electric blasting that on account of its being controlled from a distance it is safer than detonation by fuse. A recent accident in a Catskill aqueduct tunnel, where electric firing is employed, was reported in the daily press as caused by a premature explosion. As a matter of fact, it was not, but the report suggested that possibly there is a danger concealed in this method which is not duly appreciated. It is possible to take great precautions in electric firing, such as making it necessary to close several connections to complete the circuit, and placing the operation in the hands of an experienced man with the apparatus under lock and key. But the danger of accidental closing of the circuit cannot be entirely eliminated, and the system has the disadvantage of setting off the blast instantly and without warning, whereas a spit fuse, like a rattlesnake, gives fair warning of its presence. In connection with this an abstract by *Engineering Record,* Feb. 15, 1913, of a report by O. Dobbelstein, in *Glückauf,* is interesting.

Many of the new German regulations, he says, are based on the belief that the system of firing by electricity is safer than that of ignition by the ordinary cord fuse. Electric firing, for example, has been made compulsory since Jan. 1, 1912, in certain classes of mines in the Dortmund district. The belief is founded on statistical evidence given below. These figures deal with the years 1908 to 1911, inclusive, and show the number of fatal injuries in that period to have been 43 with electric firing and 51 with safety fuse, the injuries causing permanent disablement being 44 and 66, and temporary disablement 131 and 146, respectively. These figures, Mr. Dobbelstein contends, being absolute, are valueless. In place of them he gives a table, in which the figures are related to the number of men at work in the mines. In those in which electric firing only was permitted, 71,555 men were employed, the number in the mines using the ordinary fuse being 112,698. The proportion per 1000 is as follows: For fatal injuries 0.111 for electric firing and 0.076 for fuse; for permanently injured 0.101 and 0.105; and for slightly injured 0.328 and 0.220, respectively. Thus these statistics are in favor of the ordinary fuse system. This fact, it is stated, must be attributed to the often imperfect electric fuses and unsuitable firing machines used, and to the ignorance of the miner. It is practically impossible either to misunderstand or to misuse the cord fuse. But in this case also safety depends largely on the quality of the fuse. The relative value of these two systems is said to be becoming a question of the highest practical importance in view of the government regulations which are now being formulated to cover this subject.

Doubtless, as Mr. Dobbelstein states, the accidents with electric firing are largely due to poor detonators and firing apparatus and to the ignorance of the miners, but even the elimination of these unfavorable conditions would probably only put the method on a parity with fuse firing in point of safety. The choice between the two systems would not seem to be capable of legislative regulation. There are many defects in our state mining laws, and some grave omissions, but the choice of electric or fuse firing is one that may safely be left to the judgment of the operators, for the present, at least. Data of wider derivation and especially data on comparative results in America, may eventually show definite advantages for one system. The collection and analysis of such data is a thing highly to be desired.

Inside Information on Steel

A correspondent of the London *Mining Journal,* after crediting the purchase of the Tofo iron deposits in Chile to the "Steel Trust"—as to which Mr. Schwab might have something to say—goes on to remark:

> One of the main criticisms which has been against the management of the Steel Corporation is that their principal smelting works are badly situated. These smelteries are at Pittsburgh, Penn., and Gary, Ind. The ores are mainly drawn from Lake Superior district. They are taken by railway from the mines to the Lake and thence by steamer through Lake, canal and river to Pittsburgh, while in the case of Gary there is a further transhipment into railway beyond.

It will be very gratifying to the Pittsburgh people to learn that the ship canal for which they have been agitating for 15 years past is now—rather unexpectedly—in operation. The shipment of ore from Pittsburgh to Gary by rail is a new development, and shows how a great corporation may be deceived, for we remember hearing that Gary was chosen as a site, because ore deliveries could be made by water.

But Pittsburgh's gratification will be sadly tempered by the further information of this correspondent that the iron center is to be torn from it. He adds that:

> In the event of a dissolution of the Steel Trust being ordered and a reduction of the United States tariff on iron and steel, economic conditions will be in need of much modification, and the Trust will be forced to pay more attention to the exploitation of foreign markets for its products. In order to get profitable foreign trade in iron and steel, it will be necessary to establish smelting works on the Atlantic coast so as to lower production costs, and also to save hauling charges to the sea coast. . . . . Last year the Steel Trust purchased a number of valuable iron properties in British Columbia and several Pacific Coast States. Through its interests in the Colorado Iron Co. it controls extensive and very valuable iron deposits in Colorado, Utah and Nevada, which will eventually be worked from the Pacific Coast. The recent purchase of Chilean deposits would seem to indicate that the company is anticipating an extension of foreign business, and it will probably be seen later that the Corporation will establish its principal iron smelteries at Philadelphia.

The digestion of this varied information is rather difficult, but the correspondent's final sentence fills us with deepest gloom, largely because we can't see just what he is driving at.

> The general opinion in the United States is that the result of the inquiry into the organization and business practices of the Steel Trust will result in Congress advising a dissolution of the United States Steel Corporation, and the present purchase is, therefore, regarded as exceptionally significant.

We had been under the impression that the dissolution of the Corporation rested with the courts. But if the Supreme Court—or Congress, or anybody else—decrees or advises a dissolution, where does the significance of the Chilean purchase come in? Is the Steel Corporation to remove bodily to Chile? Any of our readers who is good at explaining things is requested to come forward and do it—if he can.

Spelter Statistics for 1912

By W. R. Ingalls

My revised and complete statistics of the zinc industry in the United States in 1912 are given in this article. The report of spelter production is based upon official returns by all of the smelters. Three smelters, all of them small, failed to report their receipts of ore in 1912, wherefore the statistics pertaining to the latter subject are incomplete. The spelter production of these concerns was 9664 tons and their ore consumption was probably about 16,000 tons, the major part of which came from the Joplin district, wherefore the statistics (for Missouri-Kansas and Oklahoma, in particular) are too low by about that amount.

The total production of spelter by ore-smelters in 1912 was 348,638 tons, of which 7447 tons was derived from galvanizers' dross, skimmings, scrap, etc., and the remainder from ore. The production from dross, scrap, etc., was 9030 tons in 1911 and 7793 tons in 1910. These data do not include the production of spelter by concerns which treat dross and scrap only, whose output amounts to from 10,000 to 16,000 tons per annum.

PRODUCTION OF ZINC

(In tons of 2000 lb.)

By Ore Smelters

States	1910	1911	1912
Colorado	6,564	7,477	8,860
Illinois	79,570	88,681	94,902
Missouri & Kansas	112,182	106,173	111,761
Oklahoma	34,760	46,333	76,837
East	43,989	47,172	56,278
Totals	277,065	295,836	348,638

By Dross and Scrap Smelters

1910	1911	1912
11,350	(a) 13,500	(a) 12,000

Total Production of Zinc

	1910	1911	1912
Ore smelters	277,065	295,836	348,638
Dross smelters	11,350	13,500	12,000
Totals	288,415	309,336	360,638

(a) Estimated.

The amount of the recovered spelter that should properly be counted statistically is uncertain. A good deal of scrap zinc is remelted in the manufacturing plants where it is made, e.g., in every rolling mill, and such remelted zinc should not, of course, appear in any statistical enumeration. On the other hand certain smelters buy and redistill and subsequently sell as spelter, often of excellent quality, what was distinctly a waste product. This is obviously an addition to the new supply of spelter and should be recognized just as is that which the ore smelters recover from dross, skimmings, etc. In my estimate I have conformed to this reasoning.

Of the total spelter production of the ore-smelters in 1911, concerns using coal as fuel produced 119,989 tons, or about 40% of the total. In 1912 they produced 134,077 tons, which was only about 38% of the total. This result is, no doubt, contrary to preconceived ideas, so much having been talked about the troubles of the gas smelters in 1912. Apparently the gas smelters ran as hard as they could, in order to take advantage of the favorable market conditions.

In addition to the spelter production there was an output of 492 tons of commercial zinc dust in 1912, against 254 tons in 1911. Two smelters are engaged in this business. The importations of zinc dust were about 2400 tons, against 1713 tons in 1911.

In 1910 there were produced 3398 tons of spelter in bond. In 1911 the production in this way was 9598 tons and in 1912 it was 10,879 tons. The exports of bonded spelter are stated in an accompanying table.

Along with the increase in the production of spelter in 1912, there was naturally an increase in the production of ore, which rose largely over the corresponding figures for 1911. The striking features of the ore statistics are the further large increase in the production of Colorado, which was largely accounted for by Leadville calamine and the material increases in a large number of the states west of the Rocky Mountains, such as Arizona, California, Idaho, Nevada and Utah. Montana failed to make good; instead of showing the expected increase it exhibited a decrease. This was, of course, due to the troubles of the Butte & Superior company, which now have apparently been rectified, wherefore there is but little doubt that the Montana statistics for 1913 will show a noteworthy advance.

The Joplin district gained over 1911, but only equaled the figures for 1910. The average price of spelter in 1912 was 6.8c. per lb., against 5⅜c. per lb. in 1910. It appears that even an unusually high price for spelter cannot raise the production of the Joplin district to as much as 300,000 tons.

RECEIPTS OF ZINC ORE

(In tons of 2000 lb. This table includes the receipts of ore by the smelters only and does not include the production of ore exported or what was taken by the manufacturers of zinc oxide.)

State	1910 (c)	1911 (a)	1912 (a)
Arizona	7,568	6,295	11,937
Arkansas	190	800	1,567
California	(b)	3,754	6,639
Colorado	77,065	158,528	212,423
Idaho	10,248	9,667	19,482
Kentucky	179	575	947
Missouri-Kansas	289,913	268,500	289,177
Montana	33,514	56,593	34,034
Nevada	4,915	5,666	20,654
New Mexico	15,959	10,184	25,889
New Jersey	(b)	(b)	(b)
Oklahoma	1,640	8,750	4,325
Tennessee	2,775	3,439	6,635
Utah	27,318	19,933	24,539
Wisconsin (c)	51,383	71,565	90,762
Others	46,905	44,896	56,099
Totals	569,572	669,305	805,109
Mexico	29,198	28,596	29,436
Canada	11,795	2,356	9,707
Grand totals	610,565	700,257	844,252

(a) Smelters' receipts; reports missing from three small smelters. (b) Included in "Others." (c) Including Illinois and Iowa.

The failure of the zinc mines of Arkansas to yield an output of importance was noted a good many years ago. It appears now that Oklahoma also is failing to come to the front. On the other hand, Wisconsin gains steadily.

Tennessee made a handsome gain in 1912 and undoubtedly will do much better in 1913, inasmuch as the new mill of the American Zinc, Lead & Smelting Co. will be in operation during the latter half of this year. The output of zinc ore credited to "other states" is due chiefly to New Jersey.

The importations of zinc ore from Canada and Mexico run along at about the same figure every year, especially in the case of Mexico. The importation is very much less than before the tariff was imposed, but while these

supplies are materially reduced, it is evident that our own mines are capable of making such additions as are required of them. A small tonnage of zinc ore was imported during 1912 from the far East.

In 1912, there were seven zinc smelters who produced sulphuric acid, the American Zinc, Lead & Smelting Co. being an addition to the list. The statistics of the works of this class for the last three years are as follows:

STATISTICS OF SPELTER-SULPHURIC ACID WORKS
(In tons of 2000 lb.)

	1910	1911	1912
Ore received	.....	.....	287,205
Spelter produced	100,791	115,310	127,655
Sulphuric acid produced basis 60°	202,000	252,192	262,555

As in the previous year the smelters who make sulphuric acid drew their main ore supply from the Joplin district and Wisconsin, but it is noteworthy that some of these smelters now use a good deal of Western ore. In 1911 they received 107,995 tons of blende from the Joplin district and 71,168 tons from Wisconsin. In 1912 they obtained 117,806 tons from Joplin and 87,676 tons from Wisconsin.

The total stock of spelter at smelters' works at the end of 1912 was 4264 tons, against 9323 at the end of 1911 and 23,000 tons at the end of 1910. The deliveries into consumption are computed in the accompanying table.

DELIVERIES INTO CONSUMPTION

	1910	1911	1912
Stock, Jan. 1	11,500	23,000	9,323
Production	288,415	309,336	360,638
Imports	3,452	1,637	11,115
Totals	303,367	333,973	381,076
Exports, domestic	3,989	6,872	6,634
Exports, foreign	4,468	11,270	8,700
Stock, Dec. 31	23,000	9,323	4,264
Deliveries	271,892	316,508	361,488

The deliveries in 1911 increased by 44,500 tons over 1910 and those for 1912 increased by 45,000 tons over those for 1911. These remarkable increases in two successive years have been regarded in the trade as a good deal of a mystery. The course of the market since the beginning of 1913 has indicated clearly, however, that consumers over-bought themselves very largely during 1912. In other words, although the stock in smelters' hands was extraordinarily low at the end of 1912, the stock in consumers' yards was large. Probably the actual consumption of spelter in the United States was less than the deliveries both in 1911 and 1912. The phenomenal percentage of increase shown by the statistics is in itself indicative of such a situation, and, moreover, there is confirmatory evidence in the private statements of consumers. This is, of course, a partial explanation of the recent decline in the price for spelter.

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Concentration of Low-Grade Iron Ores

A mill for concentrating low-grade iron ore has recently been built at Diorite, Mich., for the American-Boston Mining Co., a subsidiary of the M. A. Hanna Co., of Cleveland, Ohio. The mill has a capacity of 500 tons per day, and, after a number of preliminary tests, was erected near the shaft of the American-Boston Mining Co.'s mine.

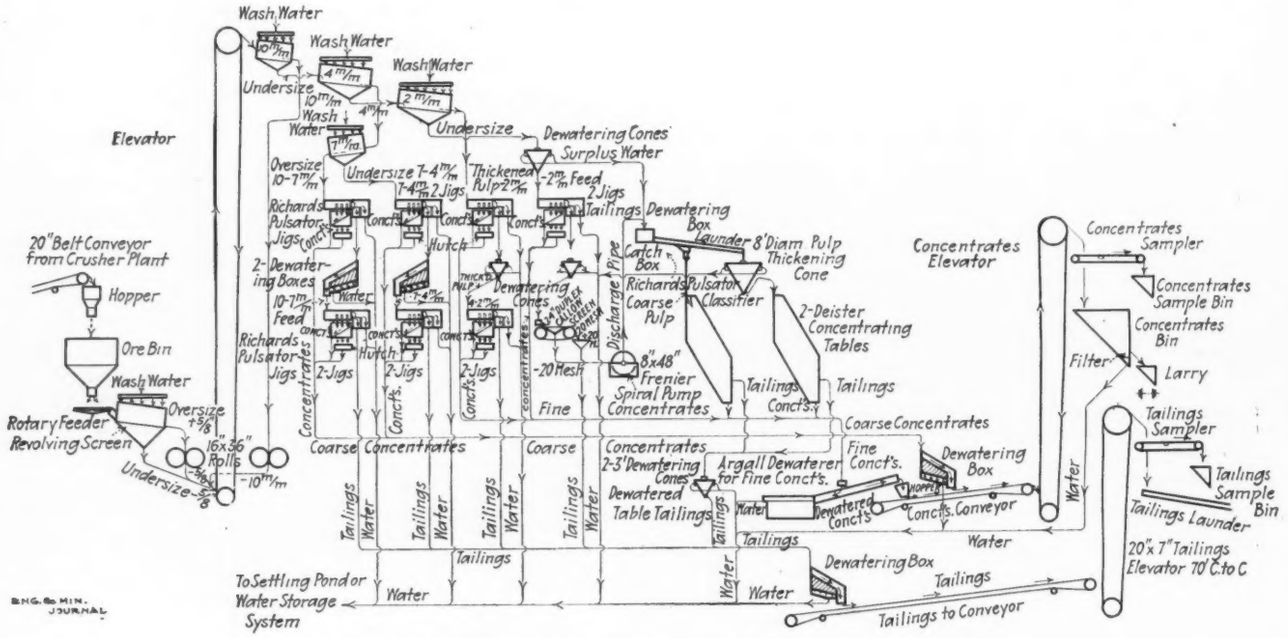


FIG. 1. FLOW SHEET OF AMERICAN-BOSTON MILL, DIORITE, MICH.

The construction of this mill makes available a large amount of low-grade ore which was not sufficiently valuable to bear shipment to the market. With the mill in operation, a good grade of concentrate can be obtained, which will bear shipping expense, and at the same time sorting of the ore is rendered unnecessary, which not only reduces the cost of underground mining, but converts a former waste into a profitable product.

The company already had in operation a crushing plant consisting of gyratory crushers and revolving screens used with their loading bins at the railroad tracks. This coarse-crushing plant is now used in connection with the concentrating mill, the low-grade ores being crushed and delivered to the mill by means of a belt conveyor. The flow sheet of the new mill is shown at Fig. 1. After being crushed through rolls, the ore is delivered to two trains of revolving screens which separate it into four sizes,

the first size being from 10 to 7 mm., the second grade 7 to 4 mm., the third grade 4 to 2 mm., and the fourth grade less than 2 mm. in size.

Richards Pulsator Jigs Used

Each class, or grade, of this material is treated through a separate group of jigs, the Richards pulsator being used, a total of 15 jigs in the mill system, nine on the upper floor and six on the lower. Coarse concentrate from the jigs on the upper and lower floor is delivered from the side gates above the screens and the finer concentrate comes from open spigots in the hutches. The tailing from the jigs on the upper floor is dewatered and treated over again in jigs placed on the lower floor. Tailing from the minus 2-mm. jigs on the upper floor is dewatered and the resulting thick pulp is screened through one 24-in. Callow screen fitted with 20-mesh screen cloth. The oversize from this screen is sufficiently low in iron to pass directly to the tailing.

That part of the pulp which passes through a 20-mesh screen is elevated to a Richards pulsator classifier of the launder type, from the bottom spigot of which the coarse pulp is delivered to one No. 4 Deister concentrator, and the oversize is thickened in an 8-ft. diam. pulp-thickening cone, and the fine thickened pulp delivered to a second concentrating table. From the jigs and tables the concentrate is dewatered by means of an Avoca dewaterer, delivering the dewatered concentrate to an elevator with about 15% moisture. The concentrate, while discharging to the storage bin, is sampled by an automatic bucket sampler. A filter is installed in the bottom of the concentrate bin in order to get rid of surplus water and leave the concentrate without extra weight for shipment. This bin is sufficiently high to discharge by gravity into an electric larry which runs on a track 30 ft. above the ground, allowing delivery of the concentrate to railroad loading bins or to stock piles.

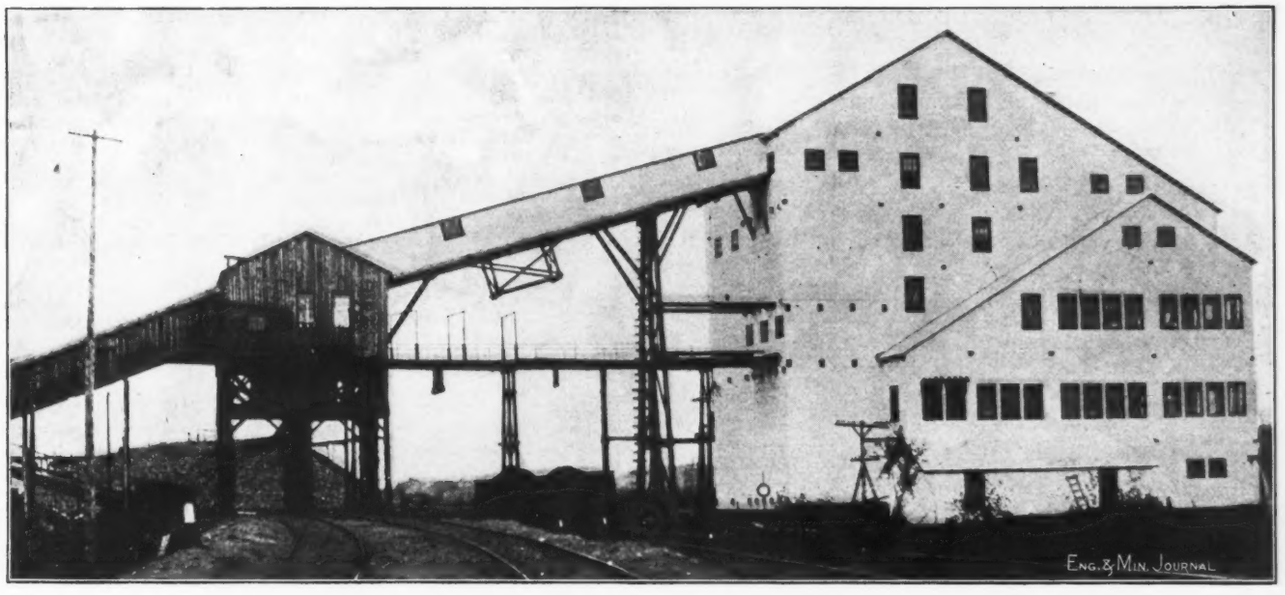
Especial attention is called to the Richards pulsator jigs used in concentrating the low-grade ores. The American-Boston mine ships a large tonnage of high-grade ore directly to market, but has also large areas of low-grade iron ore comprising both hard and soft varieties, the mineral being hematite occurring in thin bands, alternating with gangue material. This ore is difficult to jig, but it is said that the Richards machine handles it with entire satisfaction.

Mill Operated by Four Men Per Shift

Although the mill was built to handle 500 tons per day, there is space left for the installation of additional ore-handling machinery. Four men are required on each shift to operate the entire mill, a tribute to the efficiency of the automatic fixtures of the mill system, and the little attention required by the Richards jig.

An important item in connection with the jig is the large proportion of hutch concentrate produced with this iron ore. It had been previously supposed that the Richards jigs were not adapted for hutch work, but this mill shows the richer and greater amount of concentrate to be produced from the hutch spigot.

The engineers of the Michigan iron district have manifested great interest in the operation of this mill, as it is expected to demonstrate the possibility of treating extensive areas of low-grade ore in iron districts. Large mills have formerly been constructed in Minnesota for the concentration of low-grade iron ore occurring in the form of sand, but the mill now described is the first one to be used for the concentration of low-grade iron ore in a Michigan district.



Concentrating Plant of the American-Boston Mining Co., Diorite, Mich.

Additional power requirements were met by the installation of a large Curtis steam turbine with General Electric generator for supplying power to air compressors and motors. Water for operating the mill is taken from a small lake near at hand, one pumping station at the lake delivering water to a flume, which carries it by gravity to a pump station adjacent to the mill. From the sump this water is raised by a centrifugal pump to a storage tank inside the mill building. Water used in the mill is discharged into a settling pond, conveniently located, where the solids settle, and the surplus water is used again in the mill.

A few days were required for preliminary adjustment

when the mill was started, after which the mill ran steadily and two weeks from the start it was shipping 60% iron concentrate at the rate of seven standard-gage ore cars per day. As has been stated, the mill was designed leaving sufficient space for increasing its capacity, and the management expects to install a few additional jigs, which will increase the tonnage handled to 900 tons per day. James H. Christy is mill superintendent. The milling machinery was made by the Denver Engineering Works Co., which also designed and erected the mill.

Mexican Petroleum

The Mexican Petroleum Co., Ltd., has issued its report for the year ended Dec. 31, 1913.

The amount of oil on hand Dec. 31, 1912, was 6,278,272 bbl., carried on the balance sheet at a valuation of 27c. per bbl.

The average selling price of all contracts for last year was 48c. per bbl. The average year's contracts are at about 52c. per bbl. The market price, at the present time, is 65c. per bbl. at Tampico. The item of "current assets," called "oil stocks," instead of being worth the amount stated in the balance sheet, to wit, $1,695,133, is worth today approximately four million dollars.

It is expected that considerable quantities of oil will be sold during the year, in addition to the amounts already contracted, which will add largely to the earnings. There should also be substantial earnings to the company from its stock in the Petroleum Transport Co. The new topping plant and the gas-condensing plant, now nearing completion, will each add its quota to the earnings for the year. It seems reasonable, therefore, to expect that the gross earnings for 1913 should be in excess of $8,000,000.

The Mexican Situation

We opine that the determining factor in settling things in Mexico will ultimately be the money-lender. An iron hand is needed to restore order there, but in these days, as we have previously remarked, an iron hand is of no great account unless it be lined with gold. Bearing on this, the *Boston News Bureau* states the following:

For many months, in fact since the closing days of Madero's régime, Mexico has been trying to raise a loan ranging from 100,000,000 pesos down, but has been unsuccessful. According to a corporation official in close touch with Mexican affairs, these attempts have been carried on in the United States, England, France and other countries. When the Madero government ended it was found that in addition to its entire currency there had been issued the entire reserve of 60,000,000 pesos or $30,000,000 bullion held in the federal treasury against currency.

Internal revenue of Mexico has fallen to a minimum. Juarez, opposite El Paso, is the best land port of entry in that country. Normal monthly receipts of $250,000 to $300,000 have dropped to about $15,000, while at Vera Cruz, the chief Gulf port, they have dropped to under $10,000.

No demands have been made, so far as can be ascertained, by the national government of Mexico upon the various corporations operating in Mexico for financial aid. State authorities, in rebellion against the Huerta government, have, however, taken where and when they saw fit. The concessions for land in Mexico call first for surface ownership. Other concessions may be given for mineral rights to persons other than those owning surface privilege. Both state and federal taxes on mineral production have been levied, in some instances that of states amounting to 2% on gold and silver.

Mexico has a funded debt exceeding $200,000,000 carrying interest ranging from 3% to 5%. One of its assets, available for collateral against a future loan, is its holdings in National Railways of Mexico. Of $251,443,000 common stock, the government, according to the last railroad report, owned $74,771,167; also $10,000,000 first preferred of $28,831,000; $30,278,290 of $74,802,733 second preferred; or a total of $115,049,457 stock out of $223,885,177 outstanding. In addition it owned $6,000,000 of $84,801,815 prior lien bonds and $2,455,050 of $507,225,725 consolidated bonds.

The inability of the Federal Government to feed and pay its soldiers out of a depleted treasury is doubtless one of the reasons for its recent military inactivity. According to press dispatches a bill authorizing a loan of 150,000,000 pesos at 7¾% interest, secured by 62% of the customs remaining unpledged, was introduced in the Chamber of Deputies on May 8. It is said that French bankers stand ready to furnish the money on the above terms.

The Filter Litigation

Apropos of the report of an action by Judge Mayer, in the U. S. District Court for Southern New York, that we noted last week, the Moore Filter Co. informs us as follows:

We brought an action in this circuit of the U. S. Court (Southern District of New York), to enjoin the Butters company from doing any business here. At the trial they pleaded that the court had no jurisdiction because if they had done any business here the infringement would not be complete or take place short of the place where the filter process was actually being used. The court denied this plea.

The only officer of the Butters company in this country, according to the testimony of its secretary, Mr. Shepard, who took the stand, said that they had done absolutely no business at its "head office" in this city since he had been connected with the company, which covers a period of something like three years.

Under these circumstances, of course, the Court was obliged to decide that no infringement had taken place. There was no decision of any kind written.

The full text of Judge Mayer's order and decree is as follows:

Defendant's plea to the jurisdiction of the court and complainant's motion to strike the plea from the files of the court for irregularity under the present equity rules and complainant's motion for preliminary injunction coming on to be heard, and testimony in support of the jurisdictional allegations of the bill only having been taken in open court, now, after due consideration of said testimony, but without consideration being given to the said motion to strike the plea from the files of the court for irregularity under the present equity rules or to said motion for preliminary injunction, because the consideration of said motions was unnecessary, and after hearing J. Edgar Bull, Esq., in support of the jurisdictional allegations of the bill, and William Houston Kenyon, Esq., in support of the plea, it is

ORDERED that the plea be, and the same is, hereby sustained, and it is further

ORDERED, ADJUDGED and DECREED that the bill of complaint be, and the same is, hereby dismissed with costs to the defendant to be taxed, but without prejudice to a later suit on a different showing as to jurisdictional facts, and it is further

ORDERED that complainant's motion to strike the plea from the files of the court be, and the same is, hereby denied, and it is further

ORDERED that complaintant's motion for preliminary injunction be, and the same is, hereby denied.

JULIUS M. MAYER, D. J.

May 6, 1913.

Reported in New York

The Miami Copper Co., now paying dividends at the rate of $2 per share per annum, is accumulating a large surplus and is expected either to increase its dividend rate or to increase its milling capacity. The latter is believed to be in contemplation.

PERSONALS

C. F. Rand has gone to Cuba.

B. B. Lawrence has gone to Utah, on professional business.

Frank M. Estes has been appointed manager of the Creston Colorada Co., at Torres, Sonora, Mexico.

Dr. L. D. Ricketts has arrived from the Southwest and will be in New York for several weeks.

F. Steele Pilcher has accepted a position with the Compañia Minera de Peñoles, at Ojuela, Mapimi, Durango, Mexico.

J. B. Risque has been appointed general manager of the Tennessee Copper Co. and has gone to Copperhill to take charge.

W. L. Saunders has retired from the presidency of the Ingersoll-Rand Co., and has been elected chairman of its board of directors.

W. J. Hamilton, heretofore smelting superintendent, has succeeded A. B. W. Hodges as general manager of the Cerro de Pasco Co. in Peru.

John J. Kennedy has left Ducktown, Tenn., and has taken a position as superintendent of mines with the Tucson Mines Development Co. in Arizona.

Bulkeley Wells, manager of the Smuggler-Union Mining Co., Telluride, Colo., who has been visiting in Boston and New York, has returned to Colorado.

Wm. B. Dickson, president of the International Steam Pump Co., tendered his resignation at a meeting of the board of directors at New York, Apr. 30.

Howard Poillon and C. H. Poirier, forming the firm of Poillon and Poirier, have removed their offices as mining and consulting engineers to 63 Wall St., New York.

Alex. Gillies and Sam. Otisse, two well known Ontario prospectors, are heading an exploration party of six, who have set out for Northern Ungava to prospect for gold and diamonds.

W. L. Thomas, of New York, consulting engineer for the Plumbago mine, Sierra County, Calif., recently visited the mine. The Plumbago is controlled by Moore & Schley, of New York.

Frederick E. Brooks, of Walnut Creek, Calif., has been appointed superintendent of the Bonanza mine in Trinity County. He succeeds Mr. Treadwell, who was killed in a snowslide last winter.

W. B. Pearson, of Tucson, Ariz., has been appointed superintendent of the Plumbago mine in Sierra County, Calif. He succeeds Charles W. McKeekin, who has held the position since the retirement of Col. Mason W. Mather.

Dr. Siegfried Kohn, technical director of the Radium Co. of America, sailed from New York, May 15, to visit European centers on business of the company. His address will be, care Brown, Shipley & Company, Pall Mall, London.

C. W. Gardner, of Oakland, has recently been appointed assistant manager of the Yuba Construction Co. at San Francisco. Mr. Gardner succeeds E. S. Rust, who is now engaged in the rock-crushing business in Santa Barbara County.

Dr. Charles P. Neill, commissioner of labor since 1905 and recently made commissioner of labor statistics in the new Department of Labor, resigned May 13 to take a position with the American Smelting & Refining Co. to organize and conduct its labor department.

Knox Taylor, president of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., was elected president of the Tioga Steel & Iron Co., Philadelphia, at a directors' meeting last week. The latter company has just been acquired by the Taylor-Wharton company.

The Canadian Geological Survey has selected the following scientists to conduct researches in connection with the Stefanson expedition to the Arctic regions of Canada: George S. Malloch, J. J. O'Neil and Y. R. M. Anderson, geologists; Kenneth Chipman and J. R. Cox, topographers, and Henri Beauchat and D. Jenners, anthropologists.

W. L. Cumings, of the newly formed Bethlehem-Chile Iron Mines Co., left New York on Apr. 26, for the company's mines in Chile. He is accompanied by L. D. Moore, and they will do some preliminary engineering work for the next few months in connection with plans for future development. Their address will be care Minas Tofo, La Higuera, Coquimbo, Chile.

D. C. Jackling has become managing director of the several mining companies of which he has heretofore been general manager. While continuing to give general supervision to their operations he will be succeeded by a general manager at each property. It is said that in the near future Mr. Jackling will transfer his headquarters from Salt Lake to San Francisco.

OBITUARY

George R. Smith died at Mesa, Ariz., May 2, aged 33 years. He was born in Michigan, but had been a resident of Utah most of his life. He was purchasing agent for the Bamberger-De Lamar mines until he went to Arizona on account of his health.

Henry Grey died at East Orange, N. J., May 6, aged 64 years. He was born in London, Eng., and came to the United States in 1870. For many years, Mr. Grey was connected in the capacity of general manager with the Cleveland Rolling Mill Co., Cleveland, O., where he established a reputation for himself as a mechanical and rolling mill engineer. He was the inventor of the Grey universal mill for rolling flanged structural sections, and for the past 10 years had devoted himself to the development of the mill.

A Colorado pioneer, Rt. Rev. Henry Robinson, monsignor and vicar-general of the Catholic church for the Denver diocese, died May 3. He was born in Salem, Ill., was educated at St. Frances de Sales Seminary in Milwaukee and St. Vincent's College at Cape Girardeau. In 1872 he was ordained a priest in Colorado and assigned to the mining camp of Fairplay, and in 1874 took up missionary work in Park, Chaffee, Lake and Summit counties. He acted as mediator between owner and miner in troubles in the early days of Leadville. He often effected peaceable settlement of disputes over property, thereby avoiding bloodshed, and contributed largely to the reign of law in the mining districts. He was well known to mining men and had hundreds of friends outside the church world.

James Cooper Bayles died in New York, May 7, aged 68 years. He was born in New York and educated in the public schools. After serving two years in the Civil War he obtained employment with the Delamater Iron Works, of New York, and soon after that joined the engineering staff of the Raritan & Delaware Bay R.R. In 1865 Mr. Bayles became associated with Gen. Charles G. Halpin, proprietor of the New York "Citizen," and during the illness of Gen. Halpin assumed charge of the newspaper, as editor. In 1868 and 1869 Mr. Bayles was editor of the "Commercial Bulletin," from which he resigned in 1870 to accept the editorship of the "Iron Age," a position he retained until 1889. It was in March, 1887, that Mr. Bayles was appointed president of the Department of Health by Mayor Hewitt. He at first declined the offer, but when assured that it was without political significance decided to accept it. Mr. Bayles received the degree of Ph.D. from Rutgers College, and was the recipient of many other honors. In 1884 and 1885 he was elected president of the American Institute of Mining Engineers, and in 1884, president of the New Jersey State Sanitary Association, and a member of the British Iron and Steel Institute. He was elected non-resident lecturer in Sibley School of Engineering at Cornell in 1886, and was also a charter member of the American Society of Mechanical Engineers. He wrote many technical and editorial articles for the "New York Times," and his literary work covered a wide range. He leaves two sons, one a mechanical engineer at Easton, Penn., the other a mining engineer, at present in Chile.

SOCIETIES

American Society of Mechanical Engineers—The Spring meeting will be held this year at Baltimore, Md., May 20-23, inclusive, at the invitation of the Engineers' Club of Baltimore and the local members of the society. The professional sessions have as usual been arranged by the Committee on Meetings, while all other events are in charge of the local committee under the chairmanship of Layton F. Smith, past president of the Engineers' Club of Baltimore. The society is fortunate in visiting Baltimore at a time when there are features in the way of engineering work of unusual interest. The high-pressure fire system recently completed will be shown to the visitors and a demonstration given of its possibilities in throwing large volumes of water. One

of the important excursions will be over the Jones Falls conduits to inspect the newly completed sewage system and the sewage-disposal plant at Back River, which is believed to be the largest and one of the most modern in the world. These engineering features, in addition to the natural attractions of the city, the opportunity for a sail in the harbor and for an all-day excursion to Annapolis, promise an occasion of rare enjoyment. It is the intention of the president and the committee this year to make an effort to conduct the meeting exactly according to schedule, and the cooperation of the authors and members generally will be appreciated.

American Iron and Steel Institute—In announcing the fourth general meeting to be held at the Waldorf-Astoria, New York, May 23 and 24, Secretary McCleary states that on Friday there will be three sessions. That of the morning will be devoted to business topics and that of the afternoon to operating and metallurgical questions, while the evening program in connection with the banquet will deal with welfare work. The following is a tentative list of the papers to be read at the meeting:

"Transportation of Bulk Material on the Great Lakes." By H. Coulby, Cleveland, president Pittsburg Steamship Co. Discussion opened by A. C. Pessano, president Great Lakes Engineering Works, Detroit.

"In What Direction is Education Tending in the Training of Men for the Technical Professions? Is It Toward Specialization or Toward Grounding in the Broader Sciences?" By Prof. Frederick Crabtree, Pittsburgh, Carnegie Technical Institute. Discussion opened by Wm. Whigham, assistant to the president Carnegie Steel Co., Pittsburgh.

"By-Product Coke Ovens." By C. A. Meissner, New York, U. S. Steel Corporation. Discussion opened by W. H. Blauvelt, Semet-Solvay Co., Syracuse, N. Y.

"Ore Reserves in the Eastern Mesabi Range." By Geo. A. St. Clair, Duluth, Minn. Discussion opened by Sheldon Norton, Witherbee, Sherman & Co., Mineville, N. Y.

"Gas Engines." By H. J. Freyn, Allis-Chalmers Manufacturing Co., Milwaukee. Discussion opened by Arthur West, Bethlehem Steel Company.

"The Practical Value of the Microscope in the Steel Industry." By Prof. Albert Sauveur, Harvard University. "Claims and Their Adjustment." By Geo. P. Early, American Sheet & Tin Plate Co., Pittsburgh.

"The Importance of First Aid to the Injured." By Dr. William O'Neill Sherman, chief surgeon Carnegie Steel Co., Pittsburgh. Discussion opened by Dr. John B. Lowman, Cambria Steel Company.

"What Causes Fatigue?" By Dr. Thomas Darlington, secretary Welfare Committee, American Iron & Steel Institute.

INDUSTRIAL NEWS

The Merrill Metallurgical Co. announces the removal of its offices and testing laboratories to fifth floor of Rapp Bldg., 121 Second St., San Francisco, Calif.

The H. W. Johns-Manville Co., Madison Ave. and 41st St., New York, is marketing a flooring material known as J-M Mastic. The base of this flooring is asphalt mastic, a product in which a finely graded mineral aggregate is bonded together by an asphaltic cement. This flooring can be laid over any foundation which is firm and stable. The standard thickness is 1½ in., which weighs 18 lb. per sq.ft. in place. This thickness is sufficient for ordinary trucking requirements. It is claimed that this flooring provides a surface that is waterproof, practically wearproof under ordinary conditions, unaffected by acids, alkalies and brine, and noiseless. It can be made in any consistency, and while always dense, possesses a certain amount of resilience which does not cause footsoreness.

On Apr. 16, 1913, the Allis-Chalmers Manufacturing Co. took over the properties and entire operation of the business of Allis-Chalmers Co., which latter company during the last year has been in the hands of a receiver. This change marks the end of the Allis-Chalmers' receivership and the commencement of the administration of the new company.

Beginning with Apr. 16, all business has been and will be conducted by Allis-Chalmers Manufacturing Co., which will operate all departments of the business as conducted by its predecessor and will carry out all contracts on hand. It has no bonded indebtedness nor liabilities of any character. In addition to all assets of the former Allis-Chalmers Co. the new company has over $4,000,000 additional cash for new working capital, which has been raised through the recent reorganization.

The new company will operate the large West Allis works and Reliance works at Milwaukee, the Chicago works, and in addition will control the operations of the Bullock Electric Manufacturing Co. at Cincinnati. Otto H. Falk, of Milwaukee, who has been receiver of the Allis-Chalmers Co. and under whose management the operations have shown marked improvement, has been elected president of the new company. The general offices will be at Milwaukee.

All properties of the new company are in good condition and its inventories and working capital on a sound basis. Its engineering departments are well equipped and the various lines of product now turned out are of the highest quality. Under these conditions it is believed that with the present careful and intelligent management the operations will show substantial profits.

TRADE CATALOGS

Wood Drill Works, 30-36 Dale Ave., Paterson, N. J. "Talks by the Drillmaster," a pamphlet emphasizing the sturdy construction of the Wood drill.

This year is the forty-fifth anniversary of the founding by Adam Cook of the Albany Lubricating Co. Mr. Cook had succeeded in producing a compound by which lubrication could be efficiently accomplished. This compound was soon dubbed "Albany Grease" by engineers, and has ever since been known by that name. The original plant at Albany was outgrown in four years, and the business moved to New York. At present all departments are housed in a modern, commodious plant at 708-710 Washington St., New York.

George A. Scott, 607 First National Bank Building, San Francisco, Calif. Bull. No. 2. Illustrated, 16 pages, 5½x9 in. This pamphlet contains information concerning the panmotion classifier, concentrator and amalgamator and the panmotion belt concentrator invented by Carl Senn. In the first apparatus, which consists of a receptacle containing a series of plates tilted at opposite angles to one another, a classification and preliminary concentration of the unsized and unclassified feed is made, the mineral and tailings being discharged to the belt concentrator beneath at a distance of about 20 in. apart. The belt concentrator is given a side and end shake constituting the pan motion. The concentrator has a positive right-angled drive, and provision is made for a wide range of speed. One of these concentrators is being tried at the mill of the Detroit Copper Co., Morenci, Arizona.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

DRILLING—Water Attachment for Drilling Machines. Charles B. Richards, Cleveland, Ohio, assignor, by mesne assignments, to the Cleveland Rock Drill Co., Cleveland, Ohio. (U. S. No. 1,059,563; Apr. 22, 1913.)

CONCENTRATION—Method of and Apparatus for Concentrating Ore and the Like. G. S. A. Appelqvist and O. E. Tyden, Stockholm, Sweden. (Brit. No. 402 of 1913.)

CONCENTRATOR—Combined Spreader, Concentrator and Amalgamator. Karl Senn, Alameda, Calif. (U. S. No. 1,059,495; Apr. 22, 1913.)

CONCENTRATOR-BELT FEED MECHANISM. Karl Senn, Alameda, Calif. (U. S. No. 1,059,494; Apr. 22, 1913.)

FURNACES — Improvements in Metallurgical Furnaces. Morgan Crucible Co. and H. Davison and L. C. Harvey, London, Eng. (Brit. No. 6808 of 1912.)

DRY CONCENTRATOR for Separating Gold and Platinum from Sand, Etc. Holger J. Nielsen and Charles J. Borglin, San Francisco, and Ludvig C. A. Soeborg, Alameda, Calif., assignors to Bear Milling & Mining Co., San Francisco, Calif. (U. S. No. 1,061,105 and 1,061,106; May 6, 1913.)

PLACER MACHINE. Thomas H. Bell, Cleveland, Ohio, and Calvin H. Dennison, Boise, Idaho, assignors, by direct and mesne assignments, to National Placer Machine Co., Youngstown, Ohio. (U. S. No. 1,060,155; Apr. 29, 1913.)

MANGANESE STEEL—Process of Making Manganese Steel. Albert E. Greene, Chicago, Ill., assignor to American Electric Smelting & Engineering Co., St. Louis, Mo. (U. S. No. 1,060,078; Apr. 29, 1913.)

OPEN-HEARTH FURNACES—Improvements in Regenerative Open-Hearth Furnaces. H. Rehmann, Düsseldorf, Germany. (Brit. No. 17,131 of 1912.)

STEEL SCRAP—Method of Making Pig Iron from Steel Scrap. Horace W. Lash, Cleveland, Ohio, assignor to the West Coast Iron Co., San Francisco, Calif. (U. S. No. 1,061,189; May 6, 1913.)

NICKEL ALLOYS—Process of Producing Low-Carbon Nickel Alloys. Eugene A. Byrnes, Washington, D. C., assignor to Electro Metallurgical Co., Chicago, Ill. (U. S. No. 1,059,709; Apr. 22, 1913.)

RADIUM—Process for the Preparation, Isolation, and Enrichment of Radium and other Radio-active Substances. Erich Ebler, Heidelberg, Germany. (U. S. No. 1,059,531; Apr. 22, 1913.)

TIN—Process of Extracting Tin from Base Bullion. Brian Charles Besley, Howell, N. S. W., Australia. (U. S. No. 1,060,527; Apr. 29, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—May 7

Development of the Thiogen Process at the smeltery of the Penn Mining Co. at Campo Seco is progressing satisfactorily. The thiogen plant in use in April, 1912, served to determine several important factors as steps in the development and as essentials in the next plant. That plant was fully described in the "Journal" of May 4, 1912. It is believed that the chief obstacles met in the experimental stage have been overcome, some of which were noted in the "Journal" of Jan. 18, 1913. These favorable developments have led the Thiogen company to make plans for a new plant to be installed at the Penn smeltery, and which it is believed will operate successfully on a commercial scale.

Sale of the Champion Mines to the North Star Mines Co. has been practically completed. The stockholders of the Champion Mines Co. will meet, May 12, to consider the dissolution of the corporation and ratify the deal. The entire proceeding should be concluded by the end of May, at which time the two-year purchase bond will have expired. The exploration and development, under supervision of A. B. Foote, within the life of the bond, has included 9000 ft. of underground work, the intersecting of the principal vein at a depth of 2400 ft., the installation of new electrical pumping equipment, electric hoist, a new cyanide plant, the operation of 40 stamps and the employment of a maximum of 150 men. There are 40 mineral claims in the holding, including the principal mines on Deer Creek in the Nevada City district. Several of these have been large producers, the Merrifield, Nevada City, Home, Schmidt, Wyoming, Providence and West Providence. This is one of the largest mining deals in the history of California mining and insures the steady and practical operation of one of the oldest mining properties in the state. The purchase price has not been made public.

The Mammoth Smeltery at Kennett has been declared a public nuisance by a Shasta County grand jury. Since the farmers who assume that their property has been damaged by smoke fumes have been unable to persuade enough of their following to put up the money for continuing the fight against the Mammoth they have tried to induce the board of supervisors and the district attorney to bear the burden, but were informed that they would have to show cause by producing evidence of damage and this is precisely what the farmers were trying to avoid. It was not a difficult task to secure a grand jury in sympathy with the complaining farmers, and the result is that under a state law the smelting company may be proceeded against in the name of the county, provided the supervisors and the district attorney are disposed to act upon the recommendation of the grand jury. There is no doubt that the baghouse operated in connection with the Mammoth smeltery has reduced the fumes and that satisfactory results have been obtained so far as preventing actual damage to crops and land is concerned, but the farmers have never been satisfied unless they were well paid for keeping quiet. There is a possibility of the proceeding against the Mammoth being avoided by the selection of a commission of experts, such as was selected in Solano County to act upon complaints against the Selby smeltery; or the action of the county may be avoided by state legislation, providing for the investigation of the effect of smeltery fumes upon crops, lands and animals by a state commission composed of the state horticulturist, the state veterinarian and the secretary of the State Board of Health. If this act becomes a law the commission will have $5000 at its disposal for expenses, but it is feared that the act and the appropriation are not worth serious consideration, so far as any benefit to the copper-smelting industry is concerned.

DENVER—May 9

The Annual Commencement Address at the School of Mines will be made by Dr. James Douglas, May 23. The title of the address is "Principles More Important Than Practice in Technical Education."

Drilling for Oil will be done by a company of Denver business men, on a tract of ground six miles east of Denver. It is expected that it will be necessary to drill 2500 ft. before oil is reached. Artesian wells in this district have long shown traces of oil, sufficient in some instances to make the water unfit for drinking purposes.

The Moffat Tunnel Project, otherwise known as the James Peak tunnel, will be voted upon by the citizens of Denver, May 20; a bill for the city to undertake the construction of the tunnel will be thus referred to the tax payers. The tunnel is to cost about $4,500,000 and will require 2½ years to construct. The promoters propose that the city pay two-thirds the cost of construction through an issue of 40- or 50-year sinking-fund 4% bonds. The Denver & Salt Lake R.R. is to pay one-third the cost and deposit this amount, $1,500,000, before the bonds are issued. It is also to pay interest and maintenance and 1% per annum until the bonds are retired. The city is to have perpetual rights to use the tunnel for all other railroads, to transport water and electricity, etc., and to have all mineral rights. A similar bill was killed by the state legislature.

The Tax Assessment Law has stated, for 10 years, that all property in Colorado must be assessed at its full cash value, but the law has not been enforced. Valuations really have been placed at about one-third cash value and the levy for county and city purposes has been raised proportionately, giving the state the least tribute possible through its four-mills tax. The framers of the new law, under which the present assessment is being made, show their ingenuity by reducing the levies which may be lawfully made for county purposes, thus forcing county assessors to declare property at its full cash value. With this and the increased taxes on mine production, the new eight-hour law for miners, the assumption-of-risk bill placing the financial obligations of accidents on employees, and numerous provisions increasing the cost of government, the mining corporations say they have a greatly increased burden to bear.

Coal Land Surrendered to the Government, comprising 3460 acres and valued at approximately $1,000,000 was, until the surrender, held by the Colorado Fuel & Iron Co. The surrender was made in consideration of the dismissal of a suit involving 5800 acres owned by the company. The land is in southern Colorado. Future entry on the land will be permitted under the regulations and prices recently fixed. The settlement was arranged through negotiations between U. S. District Attorney H. E. Kelly, Assistant Attorney General Frederick Maynard, M. D. McEniry, chief of the field service of the General Land Office and officials of the Colorado Fuel & Iron Co. The land which is in Las Animas County originally was taken up as agricultural land. It was filed on under the law that permits owners of forest land to return it to the Government and receive in return agricultural land. Subsequently the land was turned over to the Colorado company. The Government's complaint against the company was that the entrants to the land knew they were getting valuable coal property. For four years the company has fought the case through the Department of the Interior where it secured a favorable decision. Subsequently suit was started by the Government in the Federal court, resisting the company's contention that the ruling of the Secretary of the Interior was final. New evidence was introduced and settlement resulted from negotiations that have been in progress several months.

BUTTE—May 7

The U. S. Assay Office at Helena reports that Madison County deposited the largest amount of gold during April, the amount being $44,429. Receipts from other counties in the order of production were as follows: Fergus $39,561; Chouteau, $31,753; Lewis & Clark, $4809; Broadwater, $492; Silver Bow, $181; Jefferson, $39; a total for the state of $121,204.

Restriction of Copper Production until the condition of the metal market warrants the resumption of a normal output of ore, apparently will be the policy of the larger Butte copper mining companies. The output of the Butte district during April was a little less than that of the previous month, being 22,237,580 lb., as compared to 23,780,080 lb. in March, and 28,929,040 lb. in April, 1912. Of the total production of the metal in April, the Anaconda company produced 283,340 tons of ore, yielding 17,938,580 lb. of copper; the North Butte

company, 28,100 tons, or 1,967,000 lb.; the East Butte company, 9760 tons, or 1,073,600 lb.; Tuolumne, 5720 tons, or 686,400 lb.; Alex Scott, 3000 tons, or 330,000 lb., and Davis-Daly, 2200 tons, or 242,000 pounds.

SALT LAKE CITY—May 8

Utah Is Rich in Hydrocarbons. One of these, gilsonite, a variety of asphalt, is found only in this state, although it extends over the line into western Colorado in a few places. It has numerous applications in the arts, and furnishes the basis for a local industry. The gilsonite, also called uintahite, has been developed commercially in an area about 20 miles square near Green River in Uintah County. It occurs in fissure veins from a few up to 10 ft. in width, cutting the Bridger beds of the Tertiary. One of these veins, the Duchesne, has been worked to a depth of more than 100 ft., and is traceable for about one mile, the width for the greater part of this distance being from 3 to 4 ft. The vein is nearly vertical, and is faulted in places. The material is probably derived from petroleum. The gilsonite veins extend beyond the area mentioned, and will be more extensively developed when railroad transportation is provided. The material looks like coal, but is more lustrous, and its density is less. It contains 99.5% of bitumen. Mining is done through tunnels and shafts. Coal- and metal-mining methods are combined. The rock in the veins must be broken. The dust is explosive, and safety lamps are used. Gilsonite is more valuable than asphaltum, and while the cost of production in some cases is no greater, the higher market price is due in part to the expenses of transportation, and the small number of mines in operation. The outlet for some of the gilsonite mines is a 63-mile railroad connecting with the Denver & Rio Grande at Mack, Colo. Gilsonite deposits worked by the Raven Mining Co. northeast of Fort Duchesne, are producing 50 tons or more per month. There is a wagon haul of about 100 miles to Price. The Pariette mines south of Myton are also shipping. A railroad is much needed in this section. While Utah has long supplied practically all of the gilsonite used in the country, it is only recently that a factory has been established in North Salt Lake, to work up the material to a finished product. Roofing and building felt are made by saturating material with gilsonite, mixed with about 2% of asphalt oils, and afterward rolling through heated rolls. Gilsonite is also used in the manufacture of varnishes, paints, insulation, printers' ink, and cements.

NEGAUNEE—May 10

Iron Ore Shipments for April were heavy, totaling 866,000 tons as compared to 204,000 tons in April, 1912. The increase is partly due to the earlier opening of navigation this year, but indicates that a large tonnage will be moved. Superior and Escanaba were especially busy, but all six ports made shipments as compared to April 1912 when Marquette had not yet started. Shipments are now in full swing, and all the ore carrying railroads and docks are busy.

The Lake Erie Ore Co., a Cleveland company, which has acted as selling agent for the Huron Mining Co. and Youngs interests for several years, has made new arrangements with the Youngs interests due to internal friction in the direction of the mines under control. It is understood that Youngs interests will continue to manage the Youngs mine at Iron River and the McDonald mine at Crystal Falls, but that the Groveland mine at Randville will be operated directly by the Cleveland company. New methods including stripping and steam-shovel mining may be introduced at the Groveland mine which has been an intermittent producer of low-grade siliceous ore. The Youngs mine at Iron River is a moderate producer of medium-grade, non-bessemer ore. The McDonald mine at Crystal Falls was but recently an exploration, but is now believed to have a small orebody blocked out.

RENO, NEV.—May 7

In Rochester steady development work is going on and 100 to 150 men are on the pay rolls. So far development work has shown moderate quantities of milling ore. The principal valuable metal is silver. It is said that ore is being shipped; the grades are only moderate. The general opinion that seems to prevail among men who know conditions best is that the camp is a "milling proposition" and does not justify expectations of extravagant values or high-grade shipping ores. As usual the discovery of ore in one locality generally results in considerable activity in the near neighborhood. Many of the camps which have recently been heralded as new discoveries by the daily papers are old camps which have been dormant for some time. Rochester has vitalized these camps and discoveries of minor importance are being reported from day to day. As far as can be judged but few of these have been opened up sufficiently to enable any one to predict the value of any of the finds. Information about the alleged recent discoveries at Moonlight, Sunset, Blacks Cañon, Florida Point, and other so called newly discovered camps, is hard to get. In Spring Valley a few discoveries have been made. Unionville, from which new strikes have been reported, is an old camp and the discoveries made there are of minor importance. At Star Peak a strike of gold ore has been made in Pole Cañon which heads up to Star Peak. Several lessees are at work and there are from 50 to 100 people in the vicinity. At Republic, 12 miles northwest of Millers on the west side of Smoky Valley, gold has been discovered. The importance of this, of course, has not yet been determined. Willow Creek, 15 miles west of Belmont, reports a gold discovery; no details. Millet, 80 to 85 miles north of Tonopah, on the east side of Smoky Valley, reports a gold discovery; no details. At Velvet a little gold has been discovered, but it is said that the prospectors have run out of the streak and are resting on their picks. No details about Lynn have been received here.

COBALT—May 10

In the Kerr Lake Drainage Project the mining commissioner has settled the order for the application of the Kerr Lake Mining Co. This order authorizes the applicants to drain Kerr Lake and keep it drained for seven years. They are to lay the drainage pipe across the lands held by the Kerr Lake company and the La Rose company to Giroux Lake. They are also entitled to take fresh water from either Giroux Lake or Cross Lake whichever may be most expedient and at the last-mentioned place they are given the privilege of erecting a pumping plant on the land held by the Pontiac Cobalt company. This would not interfere with the operations of that company and it could use the pumping plant of the applicants if necessary. A pipe line is to be laid as shown by a plan which has already been filed, but if this should at any future time interfere with the working of any of the lands over which it crosses, it must be moved. It is further provided in the order that the draining of Kerr Lake shall not in any way lower or raise the water of Glenn Lake or deposit silt or other débris in it that would affect any mining company having land facing on the lake. The Penn Canadian Mining Co. states that if the waters of Glenn Lake were raised one foot or materially lowered, its plant would be damaged and although it was stated by the engineers that the drainage of Kerr Lake would not interfere with the source of supply of Glenn Lake, a clause regarding maintaining the level of Glenn Lake was inserted as a precautionary measure. The Kerr Lake Majestic mine borders on Kerr Lake and the operating company is also protected in the order by a clause providing that in the event of operations being resumed, the applicants shall supply that mine with the necessary water. There is also a general clause inserted which states that operations must be carried on as indicated by the evidence and the plans of the applicants so that no damage would result to any of the owners of the property adjoining the lakes.

PORCUPINE—May 10

Shortage of Power is again being experienced at Porcupine and this time it is the Sandy Falls plant which is out of commission. At this plant, the high water is responsible for a large part of the flume being washed away. The damage is not serious, however, and it is expected that within two weeks the plant will be running again at normal capacity. The damage to the Wawaitin plant is, however, more serious and it is not expected that any considerable quantity of power can be supplied from there before the end of May.

Floating the McEnaney as a separate property is said to be under consideration by the directors of the Crown Reserve Mining Co. Although nothing official has been stated, it is believed that the plan will be as follows: The McEnaney mine to be capitalized at $2,000,000, shares at a par value of $1 and of this issue, 500,000 shares will be issued to the Crown Reserve shareholders at 80c. This will bring in approximately $400,000, which sum will be returned to the Crown Reserve Mining Co. to cover the amounts paid by the company for the development of the McEnaney property; 250,000 shares of McEnaney stock will also be paid to Mr. McEnaney for the property according to the original condition of purchase. This will leave $1,250,000 of McEnaney stock which will be taken into the treasury of the Crown Reserve Mining Co. By this plan, Crown Reserve shareholders will benefit to the fullest extent by the profits to be made from the McEnaney and it will give them full control of the operations of the mine. The development of this Porcupine property has been satisfactory and the company is now proceeding to enlarge the mill.

THE MINING NEWS

ARIZONA

Cochise County

TETER-STONE AZURITE—Much water is being encountered, although not enough to seriously handicap development. George A. Brown has succeeded C. E. Broadbeck as superintendent.

PRINCESS—The mining equipment on the property of the Empire Copper & Gold Mining Co., at Johnson, is to be moved to the Princess group, which is owned by the same company, where extensive development will be carried on. The company also proposes to resume work on the Cowboy group, near Cochise.

Gila County

MIAMI—Two of the four units of the mill that had been idle since the cave-in, resumed operations May 6. The surface equipment is being rapidly removed from the old No. 2 shaft. The new timber-yard site has been practically completed. Surface cracks attended by subsidence following the extraction of the ore by the caving system have become so pronounced as to necessitate the placing of many danger signs in the zone of caving. One hundred cars of concentrates, which were tied up on the railroad for several weeks between Miami and Cananea, have finally reached the Greene-Cananea smeltery.

INSPIRATION—Churn drilling, which was discontinued the latter part of 1911, has been renewed on that portion of ground between the Live Oak No. 1 shaft and the Silicate tunnel. The intention is to drill 15 or 20 holes; 229 holes have been drilled of a total footage of 124,686 ft. Underground connections with the incline have been completed. The waste from the Inspiration division is to be raised through the incline to the Joe Bush tunnel, and then be trammed to the surface, where it is to be utilized in making yards. The pillar-and-stope method will be followed in mining the Colorado orebody. The installation of the electric hoist at the Colorado shaft was completed Apr. 28. At the millsite operations are confined to tracklaying and work on the sand and rock bins. The warehouse has been completed. It has been definitely decided to erect a 600-ton testing mill near the Scorpion shaft. In this mill will be determined the applicability of the Minerals Separation process to Inspiration ore. Excavating for the foundations for the coarse crushing plant, near the main hoisting shafts, is about half completed. The garage near the millsite was destroyed by fire, Apr. 29. The burning of two Velie trucks with the garage accessories made the loss about $10,000. The millsite is now connected directly by rail with the main line of the Arizona Eastern R.R. The roadbed, with the exception of one cut, is completed to the main shafts, which are at the end of the branch. The remaining cut originally contained 80,000 cu.yd. of material and was termed the "Culebra" cut. The greater portion has been cut away.

Pima County

TUCSON MINES DEVELOPMENT CO.—The new 50-ton concentrator has been completed and put in commission.

SAN XAVIER—Among other improvements installed recently by the Empire Zinc Co., which recently acquired this property, are a telephone line and regular daily auto service to Tucson.

TUCSON DEVELOPMENT CO.—This company has been organized to complete the test oil well started by the Catalina Exploration Co., near Tucson. By the terms of the contract between the two companies, the Development company is to continue the work of sinking the well until oil, artesian water or a depth of 2000 ft. is reached. If oil or water is developed, the Development company is to receive 65% of the capital stock of the Exploration company.

Pinal County

LONDON-ARIZONA—Rapid progress is being made in the development of the strike of lead ore recently made in driving the drift from the Curtain to the O'Carroll shaft. A complete survey of the property has been made.

Santa Cruz County

VERDE—This group, about 15 miles east of Nogales and about one mile from the international line, has been bonded by J. H. Cunningham to Nogales men headed by E. K. Cummings.

SANTO NINO—An oreshoot of undetermined length and breadth is now showing in the main shaft, but it has already produced 300 tons of ore, and there is nearly as much more in sight. No ore is being shipped on account of the demoralized condition of traffic on the Cananea-Nogales R.R. in Sonora. A station on this line is only four miles from the mine, which is near the border.

Yavapai County

SILVER BELT—In driving in the new 200-ft. level in the first north extension, a fine body of ore 4 ft. wide was opened, 6 in. of which is specimen ore. The property is owned by the Humboldt Consolidated Mining Co.

COPPER QUEEN—The winze has now reached the 400-ft. level, and a crosscut has been begun from the bottom. Reserves have been blocked out and the company is considering the advisability of building a reduction plant.

KAY COPPER CO.—A contract has been let for sinking a new shaft 1200 ft. north of the present working shaft. Drifting to the south toward the property of the Harris Copper Co. is being continued through the main working shaft.

CALIFORNIA

Amador County

KENNEDY EXTENSION VS. ARGONAUT—The apex suit is continued by stipulation to Sept. 15, on account of the continued illness of Curtis H. Lindley, attorney for the defendant.

NORTH PLYMOUTH—This company was organized to develop and operate the Boyson mine at Plymouth. The capital stock is $150,000. The directors are Gabriel Roos, Moise Roos and Henry Osborne. The principal place of business is Plymouth.

ANGELO EGUT VS. SOUTH EUREKA—This suit to recover $30,000 was brought against the company on account of the death of Firmin Mengual, who was injured in the shaft by a falling rock and died seven days later. The plaintiff is the administrator of the estate of the deceased.

Butte County

WEEKS-ALLEN DEVELOPMENT CO.—This is a newly incorporated company organized to mine near Chico. The capital stock is $20,000, of which $7300 has been subscribed. The directors are F. S. Weeks, of Los Angeles, George C. Allen and C. E. Churchill, of Chico. The principal place of business is Chico.

Inyo County

SKIDOO—About half the repairs to the 21-mile pipe line are completed. It is expected that the 15-stamp mill will be in operation by June 1. This will make a total of five months that the mill has been idle since started in May, 1908. From that date to January, 1913, the mine has produced almost $1,000,000. Six dividends have been paid, aggregating $325,000. The last dividend, 5%, was paid in May. The mill and rock crusher are driven by water most of the year. Late in the autumn when water is low the rock crusher is driven by a gas engine. The tailing is cyanided. While the rest of the repairs to the pipe line are being made, the mill will be repaired and a new set of copper plates for the three batteries will be installed. Two new rock crushers will also be installed.

Kern County

KING SOLOMON—The last cleanup from the Teagle-Lamberson lease, of 45 tons, yielded $1600, or more than $35 per ton.

Modoc County

HIGHGRADE DISTRICT is again attracting attention from reports that the Big Four mine and 5-stamp mill are being negotiated for and that on the Spearmint lease on the Yellow Jacket a 15-ft. vein has been found at a depth of 75 ft., and that specimen ore has been found in the Sunshine tunnel. The snow is disappearing and mining men are said to be going into the district.

Nevada County

COAN—Four hundred acres of mining ground has been added to this property at Indian Flat by bond to D. J. Gillespie, of Pittsburgh, Penn., who is operating the Coan.

CHAMPION MINES—A meeting of stockholders was to be held May 12 at San Francisco to consider the dissolution of the corporation in view of the sale of the property to the North Star Mines Co. The practical completion of the sale is reported to have been reached Apr. 24.

Plumas County

GOLD MOUNTAIN—This hydraulic mine on Willow Creek will have about two months' run, judging from the amount of snow at the head of the ditches. Gravel from an 8-ft. bank is being moved by one monitor. It is estimated that the gravel will yield $1 per yd. Mr. Flagg, of Quincy, is superintendent.

BUTTE BAR—This quartz mine on Onion Creek, near Nelson Point, has been bonded to Eastern men. Development will be undertaken as soon as the trails are open and supplies can be packed in. The vein is 4 ft. wide. The district has been isolated for several years, but the operation of the Western Pacific R.R. through Plumas County affords access to the region.

Sacramento County

NATOMAS CONSOLIDATED—No. 7 dredge, which has been reconstructed, will be ready to begin digging this month. The bucket line was placed on May 3 and the tailing stacker was ready to be put aboard. This is a 9-cu.ft. dredge. It is now on Blue Ravine about 4 miles west of Folsom. It was formerly operated just out of Natoma. The machinery outlived the wooden hull, and a large part of it has been installed in the reconstructed dredge. The boat is now all steel and built on the same lines as the new No. 10 and the reconstructed No. 8, the first steel-hull boats built for operation in California.

Siskiyou County

DREDGING GROUND ON GREENHORN CREEK is being prospected by Noyes and Stebbins of San Francisco. They have bonds on ground extending along the stream for about two miles. Shafts are being sunk and Keystone drills will be operated. The ground includes the Blue Gravel mine and the Yreka submerged dam.

SISKIYOU MINES CO.—The dredge has resumed operation near Fort Jones. The snow in the mountains insures sufficient water to run until September.

Trinity County

TRINITY GOLD DREDGING Co.—The dredge has begun digging on Trinity River near Lewiston. It is electrically driven by a plant installed by the dredge company.

Tuolumne County

DANIEL MANNING VS. APP CONSOLIDATED—The Fresno County superior court has found for the defendants in the suit for damages for $17,500 on account of injuries received in the App mine. Manning had obtained judgment, which had been reversed on appeal. In the later suit the Nevills estate and the Central Land & Trust Co. were also made defendants. It has been recently reported that there is a probability that a sale of the App and other mining properties of the Nevills estate will be made this year.

Yuba County

BOSTON CONSOLIDATED—High-grade ore is reported at this mine at Browns Valley. A wagonload sample has been shipped to Selby for a test. The shaft is 200 ft. deep and a 500-ft. tunnel has been driven.

COLORADO

Clear Creek County

GOLDEN HOPE—The tunnel has been advanced 300 ft. and a small vein of smelting ore has been opened.

VIRGINIA CITY—An 8-in. vein of smelting ore showing wire silver has been opened in this mine on Lincoln Mountain.

BERTHA—This property is to be reopened by the Otho Gold Mining & Milling Co., which is a reorganization of the old Bertha Gold Mining & Milling Co.

MINT MILL—The mill has been remodeled and is now ready to resume operations. It will treat the ore from the Gold Dirt dump and will be operated as a custom mill.

WYOMING VALLEY TUNNEL—This tunnel is now 150 ft. long and is to be advanced 1000 ft. into Seaton Mountain in a direction approximately parallel to the Newhouse tunnel.

ROBERT MORRISON—This property in Ohio Gulch, near Dumont, is being operated by P. H. Stanhope. It is an old mine that has been idle for several years, and was recently reopened.

TREASURE VAULT—A 6-in. vein of rich gold ore has been developed in this mine in Virginia Cañon. The oreshoot was encountered in the east drift from the bottom of the shaft, about 90 ft. from the surface.

LAMARTINE—This property is being operated by lessees. The Lang Leasing Co. is working through the Lamartine tunnel and is drifting on the Falcon Extension vein. A large vein of pay ore is being developed.

ALCO—Development of this property in the Freeland district has been resumed. A contract has been let to sink the shaft 100 ft. to a total depth of 160 ft. A small vein of smelting ore is exposed in the bottom of the shaft.

SCOTIA MILL—This mill at Silver Plume is being remodeled and improved. Two card tables have been added to the equipment. The plant is treating 50 tons of lead-zinc ore per day, from the Pelican and Smuggler properties.

ANAMOSA—This property is on Columbia Mountain Heavy rain and snow during the last month caused a cave of the ground near the portal of the tunnel. The workings are being repaired and development will be resumed in a few days. The main adit is to be advanced and many of the old workings will be retimbered and placed in working order.

LUCKY BOY—Pay ore has been found in this property in North Spring Gulch. The vein is intersected by a crosscut 1100 ft. long. The oreshoot was opened after drifting 50 ft. on the vein. There is a small streak of shipping ore in the vein, the bulk of which is suitable for concentration. The company owns a 10-stamp mill. The new oreshoot will be thoroughly developed.

BLUE RIDGE—This company will increase the scope of its campaign of development in the mines on Columbia Mountain. A winze has been sunk to a depth of 400 ft. from the upper tunnel, and a vein has been developed, in which good gold-silver-lead ore is found. Drifts will be advanced on the vein from the bottom of the winze. Development in the lower levels is proceeding with satisfactory results. It is estimated that the reserve of low-grade ore will soon be sufficient to justify the resumption of milling operations. The company has installed electrically operated pumps, hoist and compressor. The working force at the mine has been increased.

COLORADO CENTRAL—It is reported that these old Silver Plume mines are to be reopened by the Clifford Exploration Co. and operated by lessees. The operators plan to clean out the Marshall tunnel and build a surface tram to carry the product to a suitable loading station on the line of the Argentine Central R.R. Money for development is to be raised by the sale of first-lien ore-royalty certificates, the holders of which are to participate in the profits from the sale of ore from and after May 1, 1914, until the principal invested shall have been returned, thereafter until an additional 50% of the investment has been recovered and thereafter on a preferred dividend basis of 7%.

DONALDSON—A 6-in. vein of rich gold ore has been opened in this mine on Donaldson Mountain. The ore was found on the fifth level above the Rockford tunnel and at a depth of 1300 ft. below the surface. The vein has maintained its width and grade for a distance of 15 ft. and the breast of the drift is in ore. The Donaldson vein was cut at a distance of about 2000 ft. from the portal of the Rockford tunnel and at a depth of 1800 ft. below the surface. The west drift has been advanced 1000 ft. and a raise has been extended to the 1300-ft. level. The old upper workings of the mine have a depth of 600 ft., leaving 700 ft. of undeveloped territory between the bottom of these workings and the highest opening from the lower tunnel. The property is now controlled and operated by the Rockford Leasing Co.

Gilpin County

WAR DANCE—Another rich strike has been made in this property. On the second level a 6-in. vein has been opened that assays 80 oz. per ton in gold. The shoot has been continuous during the last 20 ft. of drifting. The richest ore in this mine is usually pink fluorite containing marcasite and sylvanite.

Lake County-Leadville

THE SMALLER PRODUCERS OF LOW-GRADE ZINC ORE have been compelled to shut down, as they cannot make any profit when the price of spelter is below $6.

San Juan Region

MICKEY BREEN—This mill has been started and has about 4500 tons of ore ahead, which was mined during the winter. The ore is of a higher grade than that milled previously.

GOLD KING—The accumulation of concentrates amounting to about 35 cars, is being shipped, as the Silverton, Gladstone & Northern Ry. has opened its line as far as this mine. As soon as the road is open to the Barstow, Congress, San Antonio, Brooklyn, Telescope and other mines in the Red Mountain district they, too, will ship. The Bagley has 30 cars ready.

WANAKAH—With a view to making better recovery, the mill has been changed during the winter and is now in operation. Steel guides and feeders of an unusual pattern designed by the superintendent, Mr. Moule, have improved the work of the stamp batteries. The coarser pulp is reground in two 5-ft. grinding pans and the entire pulp is twice passed through Pierce amalgamators, which catch the free gold. One Card, one Deister, and nine Wilfley tables concentrate the crushed ore, the concentrate being elevated automatically to a series of storage and drainage tanks from which it is loaded into cars. Changes will be made in the tramway to increase its capacity to 200 tons per 24 hr. This will be ample to supply the mill and carry a large quantity of crude ore for shipment to the smeltery.

Teller County-Cripple Creek

VINDICATOR—An oreshoot has been found which is said to be the largest ever opened in the property. It is reported as being 15 ft. wide with assays ranging from 3 to 7 oz. per ton.

EL PASO—At a meeting of the directors of the Colorado Mines, Railways & Utilities Corporation, Allen L. Burris, of Cripple Creek, was elected president and W. H. Smith, secretary and treasurer. Among important resolutions passed was one authorizing the conversion of the stock of the El Paso Consolidated into the stock of this company.

MICHIGAN

Copper

ROEBLING SONS CO.—This company has announced that it will double the capacity of the wire mills at Dollar Bay, and that this plant will take care of all of the Western business, and will be the general Western agency.

SOUTH LAKE—A station is being cut at the 400-ft. level preparatory to driving a crosscut to the Evergreen series of lodes. At the 300-ft. level a crosscut is well under way to reach this series, which, according to a drill hole, lies about 300 ft. from the shaft at that depth.

ISLE ROYALE—This company has gradually increased its underground operating force and now has about 90 drills in operation, advance openings are being established and production will be increased, utilizing a head in the mill of the Lake Milling, Smelting & Refining Co. The Isle Royale mill is operating to about full capacity. Developments on the Grand Portage lode continue satisfactory.

CALUMET & HECLA—At No. 21 shaft on the Kearsarge lode the surface equipment has been enlarged, a hoisting engine of larger capacity has been installed and the rock house has been remodeled to accommodate five-ton skips. Operations have been resumed after about three weeks' shutdown. Underground operations at this shaft are showing a good grade of ore in the lower openings. Construction work is going forward satisfactorily. At the smelting plant the steel work for the electrolytic plant has been erected and the building will soon be inclosed. The new furnace, which went into commission recently, is working satisfactorily. At the site of the No. 2 regrinding plant, the main building is about completed and the foundations for the machinery are being laid; the electric substation building is completed and the apparatus is being installed and the classifier and conveyor buildings are up. At the electric-power plant the erection of machinery is going forward rapidly. A shipment of about 500 tons of sand taken from the conglomerate dump has been shipped to Anaconda, Mont., for an experimental run to test the Peck centrifugal concentrator on these sands.

Iron

LOTTA—This property in the Crystal Falls district, owned by Senator Moriarty and R. B. Webb, is being explored by Scott & Luntz. Iron formation is known to exist to the east.

FLORENCE IRON CO.—This company is resuming diamond-drill exploration on Sec. 36, 44-33, between Amasa and Crystal Falls where it drilled last year. The Cole & McDonald Exploration Co. is doing the work on contract.

LAKE SUPERIOR—At this old mine of the Oliver Iron Mining Co., at Ishpeming, a stockpile of hard ore has been accumulated at the old soft ore shaft on Pine St., which has been obtained by robbing the workings to the west.

HILLTOP—This property in the Crystal Falls district recently abandoned by the Oliver Iron Mining Co., is reported leased to the Lake Erie Ore Co., together with the adjacent Victoria property. A small body of ore is known to exist.

MONONGAHELA—On this property in the Crystal Falls district M. A. Hanna & Co. plans to sink a shaft and do development work. A small orebody was proved by diamond-drilling at the same time the adjacent Carpenter lands were explored, and the ore is an extension of the big Carpenter deposit now being opened by M. A. Hanna & Co. The fee is owned by the same interests that own the Ravenna mine.

MONTANA

Butte District

BUTTE MAIN RANGE—Preparations are being made to begin sinking a shaft on this company's property, in the eastern portion of the Butte district. A hoisting plant with capacity for sinking to a depth of 1500 ft. is being installed.

GAMBRINUS—After much opposition from property holders, and much discussion on both sides relative to the law upon the subject, the Butte city council recently conceded to the Corbin Copper Co. the right to sink a shaft upon this lately acquired property in the western part of the Butte district, consisting of the Gambrinus and Belcher lode claims. The law holds that all property in Butte and vicinity is acquired with the understanding that mineral rights take precedence. Upon receiving permission to begin development, the company at once began the work of sinking a three-compartment shaft in a vacant lot about 30 ft. north of Copper St., and 100 ft. east of Excelsior Ave., in the heart of the residence district. Sinking was begun with a windlass in order to lose no time, and concrete foundations for an electric hoist was started at the same time. The shaft is about 35 ft. deep and will be continued to the 1500-ft. level, at least, before further development work is undertaken.

Blaine County

AUGUST—Preparations are being made to build a 200-ton cyanide mill at this gold property, in the Little Rockies district. Due to the fact that the old mill was not making the recovery that it should, the mine was closed about two months ago. The new plant is expected to be ready to put in commission Aug. 1, when operations will be resumed. There are 60,000 tons of tailings on the dump to be treated, and from 150,000 to 200,000 tons of ore blocked out in the mine.

Cascade County

JOHANNESBURG—A large deposit of high-grade copper ore was opened recently in this property, near Nehart. A shipment of the ore will be made to the smeltery within a few days.

Deer Lodge County

SOUTHERN CROSS—Three trains per week are now running on the Butte, Anaconda & Pacific R.R., between Anaconda and Georgetown, and regular shipments of ore are being made from this mine to the Washoe smeltery.

Gallatin County

GARFIELD—A shaft is to be sunk on the vein and a wagon road built to the property, near Spring Hill.

Granite County

SWASTIKA—The water has been pumped out of this mine, near Philipsburg, and preparations are being made to begin operations. Negotiations are under way for the purchase of an electric hoist and sinking pump, and for the construction of a power line from Philipsburg. The shaft will be sunk several hundred feet deeper.

Jefferson County

BOSTON & CORBIN—About 200 tons of ore is being treated daily in the concentrator. About 60 tons of concentrates are saved daily and shipped to the East Butte smeltery for treatment. The ore is being mined from the 900- and 1200-ft. levels.

BLACKJACK—Owners of this property, adjoining the Boston & Corbin on the east, are negotiating with the latter company with a view of developing Blackjack ground at depth by extending the north crosscut on the 1200-ft. level into the Blackjack territory. The Blackjack is at a higher elevation than the Boston & Corbin. A shaft has been sunk 250 ft. on the Blackjack and if the management does not enter into a contract with the Boston & Corbin, an electric hoist will be installed and shaft sinking will be resumed.

NEVADA

Clark County

MOAPA GYP CO.—This company owns an extensive gypsum deposit near Moapa, and is now building a wall-plaster mill. The machinery has been ordered from Butterworth & Lowe, Grand Rapids, Mich., and the power plant, a compound corliss condensing engine with superheater and Heine boilers, has been purchased from the H. N. Tracy Co., of Los Angeles. The power plant was purchased on a guarantee, with penalty, that 1 horsepower-hour must be developed per pound of oil consumed. The mill will have a capacity of 200 tons per day and will be in full operation by midsummer.

Elko County

SEATTLE CONTACT COPPER CO.—This company is shipping high-grade copper-oxide ore from the surface workings of the Delano group of seven mining claims.

NEVADA COPPER MINING, MILLING & POWER CO.—This property at Contact, will be actively developed in the near future, as will other mines in the district, in order to block out ore so that shipments can be made as soon as the railroad is completed. W. H. Bancroft, of the Oregon Short Line, has definitely announced that a line from Rogerson, south to Contact, and thence to the Central Pacific R.R. at or near Wells, will be built this summer. The Nevada Copper Mining, Milling & Power Co. will begin sinking a working shaft on a group of centrally located claims, and will deepen another that is already down 290 ft., until it enters the permanent sulphide zone, where it is expected that concentrating ore will be found. Much ore of commercial and shipping grade has been encountered on the property within the last three years, and it is the intention of the company to begin adding to the reserve already exposed.

Esmeralda County

GOLDFIELD CONSOLIDATED—In April, 26,186 tons of ore treated, yielded $359,000; $170,000 being the estimated net profit.

Lyon County

MOHAWK GROUP—At this mine, four miles east of the Blue Jay, work has been resumed.

RENO-YERINGTON—Sinking the new, two-compartment, 6x10-ft. shaft has begun. A. Marsal is in charge of the work.

YERINGTON-MALACHITE—This property has recently been inspected. The mine adjoins the Mason Valley mine. A small force is now working through the Mason Valley ground.

YERINGTON MOUNTAIN—Development is being done by a force of 25 men. The lower tunnel is in 600 ft. A winze is being sunk from the No. 2 to the No. 3 tunnel, primarily for ventilation.

McCONNELL—This company has resumed shipping, and is now producing 50 tons daily. No. 3 tunnel is to be connected with No. 1 tunnel by raises, permitting all ore to be taken out through the lower level.

MASON VALLEY MINES CO.—Ore received at the Thompson smeltery for the week ended Apr. 30, 1913, is as follows: From the Mason Valley mine, 2535 tons; from Nevada-Douglas, 1720; from outside mines, 853 tons. Total, 5108, or a daily average of 730 tons; matte shipments from the smeltery for the same week, seven carloads.

Humboldt County

SEVEN TROUGHS COALITION MINING CO.—For the last six months this company has not been making money, in fact it had been running behind, because a fault cut off the ore on the 1000-ft. level. Recently, what is believed to be the faulted part of the vein has been found, but the ore in it is of entirely different character from that in the portion of the vein previously worked. Formerly gold ore was mined, while now the ore carries silver at the rate of 30 oz. to every ounce of gold and about 3% of copper. It is believed that this ore will widen in places just as was found to be the case with the vein worked before the fault was encountered.

Mineral County

SHIPPER COPPER—This copper property at Luning is being developed. A depth of 300 ft. has been attained and ore is being shipped.

LUNING GOLD MINES SYNDICATE—The property of this company comprises 13 claims, aggregating 260 acres, about five miles northeast of Luning. About a dozen well defined veins have been opened. The transportation facilities are good and since the completion of the smeltery at Thompson the freight charges are but 80c. and the treatment charges $4 per ton, making it possible to ship low-grade ore. Ore from some of the veins contains principally gold, while that from others contain gold, silver and lead; one of the veins produces ore that contains principally silver, some lead, but little gold. The smeltery at Thompson is not yet in position to pay full value for silver, and the lead furnace at the smeltery has not yet been completed. This has prevented the company from making shipments from the developed parts of the mine. The gold ore is comparatively free and it is believed that a good recovery can be made by milling and concentration. There is a chilean mill about eight miles from the property, and the company intends to secure this mill if possible and as soon as the gold vein has been developed to produce sufficient tonnage to make the operating of the mill practicable, milling will be commenced. Since the organization of the company in 1905 to Feb. 28, 1913, the disbursements have amounted to $53,990. Shipments of 344 tons of ore, have returned $4699 after the deduction of $2084 for freight and treatment. R. C. Todd is manager.

Nye County

SHIPMENTS in tons from Tonopah mines for the week ended May 3 were as follows:

Tonopah Mining	3,550	North Star	300
Tonopah Belmont	3,462	Mizpah Extension	....
Montana-Tonopah	1,000	Jim Butler	350
Tonopah Extension	1,085	Tonopah Merger	....
West End	1,050		
Midway	50	Total	11,341
MacNamara	494	Estimated value	$246,295

BUCKEYE BELMONT—This property adjoins the Belmont on the east. The No. 1 shaft has been sunk to a depth of 1200 ft. from which level crosscuts have been driven north and south. Both crosscuts have cut through stringers of ore and the south crosscut has cut two small veins of quartz ore. The shaft has two compartments and is equipped with an electric hoist capable of raising a two-ton skip at a speed of 700 ft. per min. A new motor has just been installed on the hoist. It is planned to continue the shaft down to the 2000-ft. level, driving crosscuts between the 1200 and 2000, and drifting on the stringers and veins. The mine is equipped with machine shops and timber-framing plant in addition to the usual mine equipment. The No. 2 shaft is 3000 ft. southeast of No. 1 and is at present idle. This shaft is 125 ft. deep, and has two compartments. It will be continued to intercept the drifting from No. 1 and No. 3 shafts. A 52-hp. electric hoist has been purchased and delivered ready to set up and the power has been wired across the property ready for use. The No. 3 shaft has been sunk to a depth of 900 ft. It has two compartments and was originally equipped with 44-hp. gasoline engine and an Ingersoll-Rand 20¼x13¼x12-in. belt-driven compressor driven by an electric motor. At a depth of 800 ft. water was struck the flow being 13 gal. per min. The fire last July burned the headframe and two sets of timbers around the collar. A temporary headframe was erected and the air compressor was connected with the pumps again, but no work other than pumping occasionally for use and fire protection has been done since. It is expected that this summer work will again be continued in No. 3 shaft. An electric station-pump will be installed and the shaft sunk to the same depth as No. 1, and drifting will be started toward No. 2 shaft, eventually to connect all the workings underground. The distance between No. 1 and No. 3 shafts is 5580 ft. The "rock heat" at a depth of 1200 ft. in the No. 1 shaft, is 105° F., and the level is dry. No. 3 shaft is wet below the 800-ft. level.

NEW JERSEY

Morris County

EMPIRE STEEL & IRON CO.—The Mount Hope Mineral R.R., which has been tied up for weeks on account of the strike at the Mount Hope mine, was dynamited at midnight, May 12, in three places simultaneously. Three hundred feet of track was destroyed. The company representatives declared the work was that of strikers, angered because a conference failed to bring the strike to an end. The section gang of the railroad quit work, fearing that if they undertook to repair the track the strikers would attack them. President Leonard Peckitt said that he would not accede to the demand of the strikers that men who had refused to strike be dismissed. That was the obstacle in the way of a settlement.

OREGON

Josephine County

BRADEN—This mine, operated by Ray Bros., of Grants Pass, will be in full operation by the last of the month.

FLANIGAN—A concentrator will be built on this property, 12 miles down the Rogue River from Grants Pass.

BLUE LEDGE—This mine, which has been idle for the last four years, will be operated during the summer. The ore contains gold and copper.

UTAH

Beaver County

LADY BRYAN—Active development work is being done at this and the Leonora properties.

MAJESTIC—During April this company shipped 32 cars of copper ore, which is an increase of 11 cars over March. The company has obtained a judgment for $23,000 against the Miners' Smelting Co., the suit having been based on the leasing of the Majestic smeltery.

Box Elder County

DRILLING FOR OIL AND GAS will be done in the natural-gas belt near Brigham City, to which place an oil-boring rig has been shipped. Prospecting is being done at three or four properties in the hills southeast of Brigham City. Development is being done on the Majestic, Gold Star and Gold Crescent claims. Work is also in progress at the Ginza Copper Co. property about five miles from Strevell, near the Utah-Idaho line.

Carbon County

SPRING CANYON COAL CO.—This company, of which Jesse Knight is president, is producing 300 to 400 tons of coal daily.

Juab County

TINTIC SHIPMENTS for the week ended May 2, amounted to 194 cars.

SCRANTON—The new equipment has been installed, and sinking has been resumed.

PLUTUS—According to report, negotiations for the sale of this property are being made.

GRAND CENTRAL—Ore assaying 15% in copper has been opened on the 2380-ft. level.

VICTORIA—There is talk of building a new ore house on a spur of the Rio Grande R.R., near the Eagle & Blue Bell, and of driving a tunnel to tap the shaft. Should this be done, the present wagon haul will be done away with.

UTAH LEAD & COPPER—Shareholders of the Bingham Copper who deposited their stock for the reorganization have received a statement from the board of directors giving details of the exchange. The new company is organized with a capitalization of $500,000, divided into shares of $1 each, and there is also a first-mortgage 6% convertible bond issue, amounting to $100,000, covering the property of the former Bingham Copper Co., as well as additional ground acquired since reorganization. One share of new stock will be given for four of the old deposited, and a bonus of one share of new stock for each dollar of assessment paid; $100 in bonds bearing interest since Sept. 1 will be given for each $100 of assessment paid.

Salt Lake County

UTAH-BINGHAM—This company's stock has been listed on the New York Curb.

U. S. SMELTING, REFINING & MINING CO.—The annual meeting will be held May 21.

LITTLE COTTONWOOD R.R.—Work on the branch line from Sandy up Little Cottonwood to Wasatch, according to report, will be started in two weeks. This line connects with the Denver & Rio Grande. If completed, it will afford better facilities for marketing Alta ores.

UTAH COPPER—R. C. Gemmell, for several years assistant general manager, has been made general manager of this company, succeeding D. C. Jackling. Mr. Jackling retains his position as first vice-president, and the office of managing director, which has been created for him by the directors.

BINGHAM-NEW HAVEN—At the annual meeting held in Salt Lake City, May 6, L. E. Stoddard, of New Haven, was re-elected president, E. B. Critchlow vice-president, F. W. Farnham, secretary and treasurer. C. H. Doolittle continues general manager. The annual report from Sept. 1, 1911, to Dec. 31, 1912, was presented, and will be printed for stockholders. This covers a period of 16 months, to make the fiscal year of the company correspond with the calendar year.

Tooele County

PROSPECTING IN THE IBAPAH MOUNTAINS will be done by several parties during the summer. This district is in the western part of the state and is reached from Wendover on the Western Pacific R.R.

LION HILL CONSOLIDATED—This property, at Ophir, is being developed along the Gladstone fissure.

WISCONSIN

Platteville District

H. E. STEPHENS LAND—Good jack drillings were found in several borings on this land at Platteville.

RODHAM—This mine, at Shullsburg, was purchased by Edward Kash on behalf of the Sheboygan Brewing Co.

EAST END—This property is again turning out 30 to 35 tons of concentrates per day; No. 2 shaft has penetrated rich ore.

GEORGE HARMS LAND—A company of 20 shareholders has been formed to prospect this land, 160 acres, just east of the Beloit Elmo.

WILSON MINING CO.—The capital stock of this company has been subscribed and operations will be resumed at the Preston Point mine near Potosi.

CANADA

Ontario

MOND NICKEL CO.—A fire at one of the buildings of this company at Victoria Mines destroyed electrical machinery valued at approximately $50,000.

Ontario-Cobalt

TIMISKAMING—A new shoot of high-grade ore has been found on the 600-ft. level.

NIPISSING—During April, ore to the value of $231,163 was mined, and ore to the value of $300,518 was shipped. Approximately 500,000 oz. was shipped from the high-grade mill. Hydraulicking operations have again started for the prospecting of Nipissing Hill.

CITY OF COBALT—This property has been purchased by the same people who control the Townsite, Casey Cobalt and Cobalt Lake mines. No definite plans regarding the mill have as yet been made, and it is possible that the Cobalt Lake mill may be enlarged to handle City of Cobalt ore. An aërial tramway would take the ore from the City of Cobalt to the Cobalt Lake. At the Cobalt Lake mill, 20 additional stamps are being installed, and these should be in operation in June.

SHIPMENTS of ore and concentrates in tons, from Cobalt for the week ended May 10 were as follows:

Bailey	....	Kerr Lake	30.11
Beaver	.....	La Rose	.....
Buffalo	.....	Lost and Found	.....
Casey Cobalt	.....	McKinley-Darragh	32.20
Chambers-Ferland	.....	Nipissing	26.34
City of Cobalt	.....	Nipissing Reduction	.....
Cobalt Lake	.....	O'Brien	.....
Cobalt Townsite	52.27	Penn.-Canadian	.....
Colonial	.....	Provincial	.....
Coniagas	100.80	Right of Way	.....
Crown Reserve	.....	Seneca Superior	.....
Dominion Reduction Co.	43.65	Silver Bar	.....
Drummond	.....	Silver Queen	.....
General Mines	.....	Timiskaming	.....
Green Meehan	.....	Trethewey	24.77
Hargraves	.....	Wettlaufer	.....
Hudson Bay	31.61	Total	341.75

Ontario-Porcupine

McENANEY—At a meeting soon to be held the directors will consider means of segregating this property from the Crown Reserve.

HOLLINGER—Operations have been practically suspended due to a shortage of power. This, however, should be remedied in about a week.

DOME—Power shortage has not affected this property to the same extent as other mines in the camp, as it has a sufficiently large power plant to permit of continuous operations, although on a somewhat reduced scale.

FOSTER—This company has to date shipped 74 tons of ore, which averaged $460 per ton. The vein is narrow, but there is stated to be a good width of milling ore. A five-stamp mill will be running in a few weeks.

GOLD FIELDS, LTD.—This Larder Lake company will install tube mills and is also considering building a cyanide plant. The grade of the ore is so low, however, that it is doubtful if the company would be able to operate profitably.

PEARL LAKE—The official report on this property, which is to be issued shortly, will contain encouraging news. At the 400-ft. level a vein was intersected and drifted upon for some distance. In the drifts, however, it was much smaller than where first opened, and on one side was cut off by a fault. On the 600-ft. level, 130 ft. of drifting has been accomplished and the average grade of the ore is stated to be high. The shaft will soon reach the 800-ft. level, at which depth diamond-drilling results show ore of good grade.

MEXICO

Jalisco

REBELS OCCUPY HOSTOTIPAQUILLO under command of Julian Mediana, a former jefe politico. The small garrison and townsfolk held off the rebels for four hours, after which the ammunition of the defenders became exhausted. Six federal soldiers were killed. When the insurgents entered Hostotipaquillo they looted the stores and burned the court house.

Sonora

GREENE-CANANEA—Operations are being extended. One section of the concentrator is scheduled to start soon. For some time past four furnaces and two reverberatories have been running.

AFRICA

Transvaal

The cable reports the gold production of the Transvaal in April at 784,974 oz., which is 5578 oz. less than in March, but 47,314 oz. more than in April, 1912. For the four months ended Apr. 30, the totals were 3,009,939 oz. in 1912, and 3,099,038 oz. —or $64,057,115—in 1913; an increase of 89,099 oz. this year.

THE MARKET REPORT

METAL MARKETS

NEW YORK—May 14

The metal markets generally have been fairly steady, but not especially active. Changes in price have not been important.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.	111	126	May	118	...	Sept.	127	...
Feb.	109	125	June	117	...	Oct.	133	...
March	111	125	July	114	...	Nov.	129	...
April	115	124	Aug.	120	...	Dec.	129	...

Average for year 1912, 119; year 1911, 112; year 1910, 115; year 1909, 115. Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Copper, Tin, Lead and Zinc

Copper—The improvement which we reported last week made further progress, especially after the publication of the American refiners' statistics for April, and a rather heavy business was transacted at advancing prices until the leading sellers raised their price asked to 15⅞c., delivered, 30 days. The bulk of the business reported was for export, but buyers in Connecticut participated to some extent, paying as high as 15¾c., delivered, usual terms. In the early part of the week there were sellers at 15⅝c. By May 10 15¾c. was generally quoted. The lead of certain agencies in raising the price above that figure was not generally followed and up to the close of the week there continued to be a number of sellers at the old price. Some sales of special brands of Lake copper were made at 16c., net cash, New York. At the close the market is steady at 15¾@16c. for Lake copper and 15.55@15.60c. for electrolytic in cakes, wirebars and ingots. Casting copper is quoted nominally at 15.35@15.45c. as an average for the week.

The standard market, after advancing on May 13, to £69 18s. 9d. for spot and £69 17s. 6d. for three months, has eased off somewhat, and the close is cabled as being weak at £69 11s. 3d. for spot, and £69 10s. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16½c. carload lots at mill.

Copper exports from New York for the week were 8434 long tons. Our special correspondent gives the exports from Baltimore at 4940 tons for the week.

Tin—The activity in the London market decreased and the tendency became weaker. Especially did this find expression in the lowering of prices for future delivery, so that at one time the bakwardation amounted to £10. Hardly any interest was shown by domestic consumers, and while upon one occasion the smaller shipments advised from England prompted dealers to put up their price for spot tin more in accordance with the importation basis, buyers were not attracted and seem to be well taken care of so far as their near-by wants are concerned. In consequence, prompt and near-by material are again offered at considerably below the price at which they can be laid down for shipment from abroad. The market closes flat at £226 for spot, and £218 10s. for three months, and 49¼c. here for May delivery.

Messrs. Robertson & Bense report the arrival of tin ore and concentrates at Hamburg, Germany, in April at 2706 tons, 7 tons being from South Africa and the rest from Bolivia.

Lead—Business is very quiet, and quotations are unchanged at 4.20@4.25c. St. Louis, and 4.30@4.35c. New York.

The London market has fluctuated within narrow limits, and closes steady at £18 15s. for Spanish lead, and 7s. 6d. higher for English.

The Board of General Appraisers on May 13 overruled an appeal from the collector at El Paso by the Consolidated Kansas City Smelting & Refining Co., in which objection was made to the assessment of duty on both the lead and zinc content of ore imported from Mexico. It was alleged that duty should have been taken on either the lead or on the zinc contained in the ore, but not on both.

Spelter—Business is in very small volume, and the market is practically featureless. If quotations have not yielded further, it is probably due to the fact that orders have not presented themselves in sufficient volume to justify marked concessions. The close is weak at 5.25@5.30c. St. Louis, and 5.40@5.45c. New York.

The London market is somewhat lower, the close being cabled at £25 5s. for good ordinaries, and £25 12s. 6d. for specials.

Base price of zinc sheets is now $7.75 per 100 f.o.b. La Salle-Peru, Ill., less 8% discount.

Shipments from Baltimore last week included 224,000 lb. spelter to Glasgow.

Other Metals

Aluminum—The market is not at all active. Deliveries are chiefly on contract, and there has not been much selling on new orders. Quotations are weaker, and are 26¼@26¾c. per lb. for No. 1 ingots, New York.

DAILY PRICES OF METALS

NEW YORK

May	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
8	4.8630	60	15⅝ @15⅞ 15⅝	15.40 @15.50 15.45	50⅜	4.30 @4.35 4.30	4.20 @4.25 4.20	5.40 @5.45 5.40	5.25 @5.30 5 25
9	4.8605	60½	@16 15⅝	@15.55 15.50	50⅛	@4.35 4.30	@4.25 4.20	@5.45 5.40	@5.30 5.25
10	4.8585	60⅜	@16 15⅝	@15.60 15.55	50⅛	@4.35 4.30	@4.25 4.20	@5.45 5 40	@5.30 5.25
12	4.8600	60⅜	@16 15⅝	@15.60 15.55	50⅛	@4.35 4.30	@4.25 4.20	@5.45 5.40	@5.30 5.25
13	4.8605	61	@16 15⅝	@15.60 15.55	50	@4.35 4.30	@4.25 4.20	@5.45 5.40	@5.30 5 25
14	4.8630	61	@16	@15.60	49¼	@4.35	@4.25	@5.45	@5.30

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

May	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
8	27 11/16	69⅛	69 1/16	75	230	222¼	18⅜	25½
9	27 11/16	69⅛	69 1/16	75½	229¾	221¾	18⅜	25½
10	28	....	....	....	....	....	....	....
12	...	....	....	....	....	....	....	....
13	28 1/16	69 11/16	69⅛	75½	229½	219½	18½	25½
14	28⅛	69 1/16	69⅛	75½	226	218½	18¼	25½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.: £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¼c.

Antimony—Business has been rather dull, buyers being inclined to hold back until the tariff is settled. Quotations are unchanged. Cookson's is 8.80@9c. per lb.; Hallett's, 8.25@8.50c., while 7.70@7.90c. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is still rather quiet with prices unchanged. New York price is $39 per flask of 75 lb., with 58c. per lb. for small lots. San Francisco, $38,50 for domestic orders and $36 for export. The London price is £7 10s. per flask, with £7 2s. 6d. named from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was no especial demand. In New York $6,000,000 gold has gone to Paris and more is expected to go.

Platinum—Trade is quieter than it has been, but prices remain firm. Dealers continue to ask $45@46 per oz. for refined platinum. Hard metal is $49@53 per oz., according to proportion of iridium.

Iridium—Supplies are still limited and the demand is good. Prices vary a little, but the general level is about $85 per oz., New York.

Silver—The market has shown an advancing tendency on buying for China, and closes quiet and steady at 28⅛d. in London.

Exports of silver from London to the East, Jan. 1 to May 1, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£2,428,800	£2,601,300	I. £172,500
China	630,000	166,000	D. 464,000
Total	£3,058,800	£2,767,300	D. £291,500

Exports of silver from New York week ended May 10 were $1,077,366, chiefly to London, Imports were $140,936, chiefly from Central America.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 10

The high price of zinc blende is $46.50, the base per ton of 60% zinc $42@43.50. Calamine sold at $20@22 per ton of 40% zinc. The average of all grades of zinc is $40.82 per ton. Lead declined $1 per ton, the base being $52.50 per ton of 80% metal contents. The average of all grades is $50.84 per ton.

SHIPMENTS WEEK ENDED MAY 10

	Blende	Calamine	Lead ore	Value
Totals this week ..	11,754,880	744,590	2,228,410	$311,794
19 weeks	205,614,270	13,982,430	35,746,980	$5,908,749

Blende value, the week, $246,444; 19 weeks, $4,777,778.
Calamine value, the week, $8694; 19 weeks, $189,434.
Lead value, the week, $56,656; 19 weeks, $941.537.

PLATTEVILLE, WIS.—May 10

The base price paid this week for 60% zinc ore was $40@43 per ton. The base price paid for 80% lead ore was $53 per ton.

SHIPMENTS WEEK ENDED MAY 10

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,155,270	64,500	1,236,100
Year to date	52,476,000	2,575,430	23,107,610

Shipped during week to separating plants, 1,897,890 lb. zinc ore.

OTHER ORES

Tungsten Ore—A recent Consular report says that during the year 1912, a total of 1862 short tons of wolframite (tungsten ore) valued at $698,185, were exported from the Province of Burma, as compared with only 995 short tons in 1911. Radcliff & Co., of Rangoon, estimate that the percentage of WO_3 contained in wolframite exported from Burma runs from about 65 to 70 usually.

NEW CALEDONIA ORES

Exports of ores from New Caledonia, two months ended Feb. 28, as reported by the "Bulletin du Commerce" of Noumea, included 9976 tons nickel ore and 2711 tons of chrome ore.

IRON TRADE REVIEW

NEW YORK—May 14

There is a contest between fundamental conditions, which are sound, and sentiment, which is pessimistic. Undoubtedly traders are influenced by the extreme pessimism in Wall Street, and they are also affected by the continued declines in pig iron, with such stagnation that actual market prices are not disclosed. Some observers hold that the summer will be dull, with an improvement in the fall, others that business on books will carry producers through summer, the dullness in the later portion of the year, while others maintain that while actual shipments will continue fairly good throughout this year, next year is going to witness the most trying times the industry has seen for years. Never has there been such diversity of prediction, while all predictions are alike in the one element of containing a strong note of pessimism. The material foundation of the industry is essentially sound, for the mills are well booked up, there are no cancellations of orders, and material shipped—at the greatest rate on record—is being actually consumed. From a disinterested viewpoint, the augury all seems to be for improvement within a relatively short time, it being better to have good fundamental conditions with sentiment pessimistic than poor fundamental conditions with sentiment optimistic.

The steel trade, operating at full capacity, shipping its material as fast as made, and seeing the material go into actual consumption, and seeing finished steel prices very well maintained, has been quite disturbed by the continued decline in pig iron and the present stagnant market. In these circumstances, an upturn in pig iron, which is not simply posible but more or less probable within the next few weeks, would certainly tend to improve the whole complexion of affairs.

The taking of testimony in the Government suit against the Steel Corporation was resumed on May 13. The first witness on behalf of the Corporation was President Farrell who went minutely into the methods of conducting its business, and was well supplied with statistics. His first day's testimony related largely to the export business and the way in which it had been built up and extended.

Pig Iron Production—The reports of the blast furnaces, as collected and published by the "Iron Age" show that on May 1 there were 298 coke and anthracite furnaces in blast, having a total daily capacity of 92,700 tons; an increase of 2750 tons over Apr. 1. Making allowance for the charcoal furnaces, the total make of pig iron in April is estimated at 2,788,000 tons; for the four months ended Apr. 30 at 11,038,000 tons. Of this total 7,618,000 tons, or 69%, was made by furnaces operated by steel companies.

The United States Steel Corporation reports unfilled orders on its books Apr. 30 at 6,978,762 tons of material; a decrease of 490,194 tons from Mar. 31, and of 953,402 tons from Dec. 31, 1912. The total on Apr. 1 is less than at the close of any month since Oct. 31, 1912; but is greater than for any previous month since June, 1907. The excess over April, 1912, is 1,313,877 tons.

PITTSBURGH—May 13

The Steel Corporation's unfilled orders decreased 490,000 tons during April, or slightly more than the combined decreases in the three preceding months, but shipments for the month were about 1,100,000 tons, showing that the Corporation really did book a great deal of new business, whereas the trade reports during the month all referred to new buying being almost absent. If the report is not good, it at least shows no bad thing which was not already well known. With the losses in unfilled tonnage during the past four months, the Corporation is set back only to a position midway between that on Oct. 1 and that on Nov. 1, whereas at that time the amount of business on books was regarded as quite good.

Pig Iron—The Westinghouse Electric & Manufacturing Co. has not acted on its inquiry for its second half pig-iron requirements, about 15,000 tons, but is likely to do so late in the week. Low prices are expected, down possibly to a basis of $14.50, Valley, for No. 2 foundry. This company has made a record in past years for picking the low points, and has an important following among smaller buyers, so that if it buys there is likely to be other buying and the temper of the market has clearly been that if the prolonged stagnation should be broken by a moderate amount of buying a genuine movement would be started which would result in better

prices. Bessemer and basic quotations have been purely nominal of late, far above the proper relation with foundry iron, and a definite market for foundry iron would probably result in readjustment in steel-making iron prices which would enable buyers to take hold. Accordingly there is a decided possibility of an overnight change in the pig-iron market which has been declining steadily since late in November. We quote as follows, prices being more or less nominal: Bessemer, $17; basic, $15.50; foundry, $15; forge, $14.50; malleable, $15; all f.o.b. Valley Furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market is entirely stagnant, buyers waiting to see whether sellers will reduce prices to meet the heavier duty to be imposed in the tariff revision. We quote prompt and forward at $61, Baltimore, with $2 freight to Pittsburgh.

Connellsville Coke—The prompt furnace coke market has been more active than for several weeks, two consumers having made purchases aggregating between 10,000 and 20,000 tons, and the prompt market is stiffer in consequence. Inquiry for second half has at last appeared, one consumer asking for prices on 10,000 tons a month while there are rumors of other inquiries. Consumers regard the $2.50 asking price on contract as out of the question but their ideas are apparently not so far below it as formerly. We quote prompt furnace at $2.10@2.25, contract furnace at $2.50 asked, prompt foundry at $2.85@3.25 and contract foundry at $3@3.25 per ton at ovens.

Steel—The supply of steel continues very limited, but quotations are more freely made, and are quite uniform at $28.50 for prompt billets, $29 for prompt sheet bars, $27 for third-quarter billets and $27.50 for third-quarter sheet bars, f.o.b. maker's mill, Pittsburgh or Youngstown.

Sheets—A sale of 1000 tons of black sheets has been made for second half at the regular price of 2.35c., under fully competitive conditions and the market is considered fairly firm on this basis, with galvanized shaded no more than formerly. Production is slightly heavier, the leading interest having worked up to operating 81% of its sheet mills. We quote: Blue annealed, 10 gage, 1.75c.; black, 28 gage, 2.35c.; galvanized, 28 gage, 3.40@3.50c.; painted corrugated, 2.55c.; galvanized corrugated, 3.50@3.55c. per pound.

IRON ORE

Shipments of iron ore from the Lake Superior district in April are reported by the "Iron Trade Review" as follows, in long tons:

Port	1912	1913	Changes
Escanaba	80,530	217 029	I. 136,499
Marquette	.....	37,494	I. 37,494
Ashland	8,288	53,481	I. 45,193
Superior	64,416	252,875	I. 188,459
Duluth	18,237	160,372	I. 142,135
Two Harbors	32,571	145,136	I. 112,565
	204,042	866,387	I. 662,345

The large increase was due to the earlier opening of navigation this year.

The rail rates on Old Range ores to the Lake ports continue this season at 40c. to Ashland, 40c. to Escanaba and 25 to 30c. to Marquette. All the carriers, however, are this year making the charge of 5c. per ton for storage and loading. Moreover ore must be loaded in 10 days from arrival or an extra charge of 0.25c. per day is made.

There are persistent rumors that some lots of nonbessemer ore have been sold at 25c. per ton below the fixed price. So far it has been impossible to verify these reports.

COKE

The Maryland Steel Co. has let a contract to the H. Koppers Co., Chicago, for 120 byproduct coke ovens of the Koppers type, to be erected at its steel plant at Sparrow's Point.

The Cambria Steel Co. has let a contract for a battery of 28 byproduct coke ovens at Johnstown, to the Gas Machinery Co., of Cleveland, Ohio.

Anthracite Shipments in April were 5,996,129 long tons; in April, 1912, which was the first month of the suspension of mining last year, they were only 266,625 t ns. F r the four months ended Apr. 30, the total shipments were 18,475,976 tons in 1912, and 22,886,065 in 1913; increase, 4,410,089 tons.

Coal production of German Empire three months ended Mar. 31, metric tons:

	1912	1913	Changes
Coal mined	42,021,733	47,558,449	I. 5,536,716
Brown coal mined	20,413,947	20,917,977	I. 504,030
Coke made	6,742,553	7,991,860	I. 1,249,307
Briquettes made	5,841,900	6,484,485	I. 642,585

Of the briquettes reported this year 5,048,260 tons were made of brown coal or lignite.

CHEMICALS

NEW YORK—May 14

The general market is rather quieter than it has been

Arsenic—Business is quiet and prices are unchanged. Current quotations are $3.75@4 per 100 lb. in carload lots.

Copper Sulphate—Business is fair with sales on a good basis. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is rather quiet, the active season being over. Quotations are unchanged at 2.60c. per lb. for spot, 2.57½c. for May, 2.55c. for June, 2.50c. for July and August and 2.47½c. for later deliveries.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield ther is reckoned at 97%. In computing the total American supply duplications are excluded.

	Jan.	Feb.	March	April
Alaska shipments	1,668,328	660,250	472,293	1,730,252
Anaconda	21,000,000	21,250,000	22,900,000	23,800,000
Arizona, Ltd.	3,100,000	3,000,000	3,200,000	3,100,000
Copper Queen	7,554,966	6,810,706	7,558,709	8,210,166
Calumet & Arizona	4,750,000	4,050,000	4,250,000	4,500,000
Chino	3,298,030	3,898,998	4,464,723	.....
Detroit	1,769,071	1,689,277	1,640,671	1,856,517
East Butte	1,469,000	1,325,000	1,400,000	.....
Mammoth	1,957,804	1,661,150	1,641,091	1,450,000
Giroux	650,000	*600,000	*625,000	.....
Mason Valley	1,655,319	1,348,070	1,608,492	.....
Nevada Con	4,169,705	4,798,537	5,555,320	.....
Ohio	492,760	380,849	596,651	.....
Old Dominion	2,727,000	2,381,000	2,853,000	3,040,000
Ray	3,610,000	3,610,000	4,287,400	.....
Shannon	1,232,000	1,152,000	1,260,000	1,238,000
South Utah	*ni.*	*ni.*	*nil*	.....
United Verde*	2,900,000	2,750,000	3,000,000	.....
Utah Copper Co.	7,182,495	7,585,303	8,248,880	.....
Lake Superior*	17,500,000	19,000,000	19,000,000	.....
Non-rep. mines*	7,500,000	7,000,000	8,000,000	.....
Total production	96,186,478	94,950,141	102,562,230	.....
Imports, bars, etc.	34,026,236	21,372,292	.....	.....
Total blister	130,212,714	116,318,433	.....	.....
Imp. in ore and matte	7,563,758	9,459,432	.....	.....
Total American	137,776,472	125,781,865	.....	.....
Miami†	2,932,369	2,817,200	3,102,200	2,312,900
Shattuck-Arizona	1,381,422	1,136,480	1,234,450	.....
Brit. Col. Cos.:				
British Col. Copper	720,260	688,312	844,735	794,000
Granby	1,792,245	1,740,000	1,967,962	.....
Mexican Cos.:				
Boleo†	2,658,880	2,535,680	2,204,720	2,811,200
Cananea	5,450,000	4,880,000	4,772,000	3,581,690
Moctezuma	2,913,294	2,730,914	3,062,159	2,753,240
Other Foreign:				
Braden, Chile	1,484,000	1,178,000	1,472,000	1,512,000
Cape Cop., S. Africa	770,540	.....	732,480	.....
Kyshtim, Russia	1,644,160	1,352,960	.....	.....
Spassky, Russia	974,400	1,003,520	974,400	.....
Exports from				
Chile	6,752,000	5,824,000	7,840,000	7,616,000
Australia	9,744,000	5,512,000	6,944,000	6,608,000
Arrivals in Europe ‡	17,689,280	8,509,760	15,585,920	10,545,920

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

Month	United States			Visible Stocks.		
	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
IV, '12	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V	126,737,836	72,702,277	69,485,945	695,066,02	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	.....	.....	.....	75,549,108	85,948,800	161,497,908

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich.	June 16	.....	$1.00
Benton, Ida.	Apr. 20	May 20	0.0025
Best & Belcher, Nev.	May 20	June 10	0.05
Big Indian Copper, Utah.	May 13	June 4	0.018
Blue Star, Ida.	May 10	June 17	0.04
Booth	May 19	June 23	0.02
Columbus Ext., Utah.	Apr. 26	May 19	0.02
Con. Imperial, Nev.	May 6	May 28	0.01
Deer Trail, Utah	May 8	June 6	0.005
Field Gold Copper, Utah.	May 13	June 4	0.015
Hale & Norcross, Nev.	May 5	May 26	0.05
Jack Waite, Ida.	May 3	May 24	0.01
Knickerbocher, Ida.	Apr. 24	.....	0.005
Moonlight, Ida.	Apr. 19	May 22	0.005
North Lake, Mich.	May 19	.....	1.00
Overman, Nev.	May 28	June 18	0.05
Sandstorm Kendall, Nev.	May 12	June 16	0.01
Santaquin Central, Utah.	Apr. 21	May 31	0.005
Trade Dollar Ext., Utah.	May 29	June 17	0.005
Tuscumbia, Ida.	Apr. 26	May 24	0.001
Union Con., Nev.	May 14	June 4	0.10
United Copper, Mont.	May 15	.....	0.30
Utah Centennial, Utah.	May 15	June 2	0.002
Wasatch, Utah	Apr. 19	May 24	0.01

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	.....	16.245	.....	72.352	.....
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78.670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	12.962	48.766	195.036	220.150
March	12.577	46.832	192.619	213.645
April	43.923	49.115	200.513	224.119
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	.....	4.072	.....	16.509	.....
June	4.392	.....	4.321	.....	17.588	.....
July	4.720	.....	4.603	.....	18.544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6.727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.3	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS May 13

Name of Comp.	Bid.
Acacia	‡.02⅝
Cripple Cr'k Con.	‡.01
C. K. & N.	‡.14
Doctor Jack Pot	.07
Elkton Con.	.58½
El Paso	3.80
Findlay	.03¾
Gold Dollar	.10
Gold Sovereign	‡.02½
Isabella	.11
Jack Pot	.05½
Jennie Sample	‡.03½
Lexington	‡.008
Moon Anchor	‡.01
Old Gold	.02⅜
Mary McKinney	.59½
Pharmacist	‡.01½
Portland	.97
Vindicator	.92
Work	‡.004

SALT LAKE May 13

Name of Comp.	Bid.
Beck Tunnel	.08
Black Jack	.09
Cedar Talisman	.02
Colorado Mining	.13½
Columbus Con	.06
Crown Point	.02½
Daly-Judge	‡6.25
Grand Central	.68
Iron Blossom	1.35
Little Bell	‡.35
Lower Mammoth	.04½
Mason Valley	‡6.25
May Day	.11
Nevada Hills	1.05
New York	‡.03
Prince Con	.47½
Silver King Coal'n	3.92½
Sioux Con	.02½
Uncle Sam	.05
Yankee	‡.07½

TORONTO May 13

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09	Foley O'Brien	.27
Coniagas	.07½	Hollinger	17.25
T. & Hudson Bay.	‡64.00	Imperial	.03
Timiskaming	.35	Jupiter	.48
Wettlaufer-Lor.	.12	Pearl Lake	.51
Apex	‡.02½	Porcu. Gold	.18
Crown Chartered	.00½	Preston E. D.	‡.04
Dobie	‡.15	Rea	.25
Dome	‡17.50	Swastika	.08
Dome Exten.	.09	West Dome	‡.34½

SAN FRANCISCO May 13

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	‡.07	Belmont	6.20
Belcher	.20	Jim Butler	.86
Best & Belcher	‡.01	MacNamara	.17
Caledonia	1.07½	Midway	.48
Challenge Con.	.05	Mont.-Tonopah	1.50
Chollar	.03	North Star	.56
Confidence	‡.33	West End Con.	1.17½
Con. Virginia	.15	Atlanta	.15
Crown Point	.20	Booth	.04
Gould & Curry	.02	C.O.D. Con	.05
Hale & Norcross	.07	Comb. Frac	.04
Mexican	.75	Jumbo Extension	.23
Occidental	.70	Pitts.-Silver Peak	.50
Ophir	.15	Silver Pick	.05
Overman	.28	St. Ives	‡.30
Potosi	‡.02	Tramp Con	‡.01
Savage	.04	Argonaut	‡1.55
Sierra Nevada	.18	Bunker Hill	1.60
Union Con.	.15	Central Eureka	.12
Yellow Jacket	.20	So. Eureka	2.75

N. Y. EXCH. May 13

Name of Comp.	Clg.
Amalgamated	75⅝
Am. Agri. Chem.	49⅛
Am. Sm. & Ref., com	67⅛
Am. Sm. & Ref., pf.	102⅝
Am. Sm. Sec., pf. B	83½
Anaconda	38¼
Batopilas Min.	1
BethlehemSteelpf	69⅜
Chino	39⅝
Federal M. & S., pf.	35
Goldfield Con.	2⅛
GreatNor., ore, ctf.	33
Guggen. Exp.	45⅛
Homestake	101
Inspiration Con.	17⅝
Miami Copper	23
Nat'nalLead, com.	47
National Lead, pf.	105
Nev. Consol.	16¾
Phelps Dodge	200
Pittsburg Coal, pf.	80⅞
Ray Con.	18⅛
RepublicI&S, com.	22
Republic I & S, pf.	82
SlossSheffil'd, com.	31
Sloss Sheffield, pf.	90
Tennessee Copper	34⅛
Utah Copper	52¼
U. S. Steel, com	60¼
U. S. Steel, pf.	106½
Va. Car. Chem., pf.	95¼

BOSTON EXCH. May 13

Name of Comp.	Clg.
Adventure	1
Ahmeek	300
Algomah	.60
Allouez	32¼
Am. Zinc	23
Ariz. Com., ctfs.	3½
Bonanza	.38
Boston & Corbin	1¾
Butte & Balak.	2⅛
Calumet & Ariz	63⅞
Calumet & Hecla	455
Centennial	12¾
Cliff	2
Copper Range	43½
Daly West	2½
East Butte	12
Franklin	5⅞
Granby	63
Hancock	19¼
Hedley Gold	32
Helvetia	.30
Indiana	9
Island Cr'k, com.	46⅛
Island Cr'k, pfd.	81¾
Isle Royale	22½
Keweenaw	1¾
Lake	12½
La Salle	3⅞
Mass	3¾
Michigan	1
Mohawk	50
New Arcadian	1½
New Idria Quick.	3⅞
North Butte	28⅝
North Lake	1
Ojibway	1⅜
Old Dominion	47
Osceola	85
Quincy	67
Shannon	8¾
Shattuck-Ariz.	24
Superior	27⅛
Superior & Bost.	3¼
Tamarack	28
Trinity	3½
Tuolumne	2 3/16
U. S. Smelting	39
U. S. Smelt'g, pf.	46¾
Utah Apex	1¾
Utah Con	7⅛
Victoria	1
Winona	2
Wolverine	50⅛
Wyandot	.90

LONDON May 13

Name of Com.	Clg.
Camp Bird	£0 19s 0d
El Oro	0 15 0
Esperanza	1 4 6
Mexico Mines	5 15 2
Oriental Con.	1 8 4
Oroville	0 6 9
Santa Gert'dis	1 6 9
Tomboy	1 3 2

BOSTON CURB May 13

Name of Comp.	Last
Alaska Gold M.	11⅛
Bingham Mines	2½
Boston Ely	1
Boswyocolo	‡.01
Butte Central	2
Cactus	.07
Calaveras	2½
Chief Cons	1½
Corbin	.85
Cortez	.30
Crown Reserve	3 13/16
Eagle & Blue Bell	.98
First Nat. Cop.	1½
Majestic	.40
Mexican Metals	.96
Moneta Porc.	‡.06
Nevada-Douglas	1½
New Baltic	.90
Oneco	1
Raven Copper	.10
Rhode Island Coal	.03
Smokey Dev.	1½
S. W. Miami	2
South Lake	5½
Trethewey	‡.36
United Verde Ext.	.68

‡Last quotation.